THE DEVELOPMENT OF BREAST AND BOTTLE FEEDING IN HUMAN INFANTS.

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ABSTRACT

This thesis describes an observational study of the development of feeding behaviour in the breast and bottle fed human infant from birth to six months. The main aim was to explore the capacity of the infant to express satiety behaviourally. Naturally occurring behaviours were identified and categorised according to various objectively defined criteria during an initial period of observation on approximately 60 mother-infant pairs. A further sample of 20 mother-infant pairs was then used to examine more systematically a selected group of these behaviours. Each pair was visited at monthly intervals from birth to six months, and it is the data drawn from the results of these visits which forms the basis of this thesis.

In the exploration of the infant's capacity to express satiety, an attempt was first made to identify potential satiety signals. Behaviours were observed in the neonate which had this potential, but the nature of their expression was found to depend upon age and feeding technique. The value placed on these potential signals was then assessed through the mother's behaviour, where it was found that her behaviour varied according to the feeding technique. Differences were described in terms of the concept of mother or infant control. Discussion of the findings brought out the possible influences that milk composition and the nature of mother control may have on the opportunities available for development in the infant's feeding behavioural repertoire.

CONTENTS

CHAPTER ONE

REVIEW OF THE LITERATURE.

1.1 INTRODUCTION

This thesis describes an observational study of the development of feeding behaviour in human infants from the age of three to six days up to six months, incorporating an ethological approach.

Interest in infant feeding practices has a long history. Indeed the literature available is large, widely dispersed and cross disciplinary, but by no means all of the studies contribute to the furtherance of any understanding of feeding as a behaviour in itself. It is, therefore, only this aspect of the literature that will be reviewed here. In classical ethological terms, feeding behaviour can be divided into appetitive behaviours and consummatory actions. Translated into more general everyday usage these comprise actions that indicate a readiness to eat, activities concerned with eating, and actions that indicate satiety.

Studies have been drawn from developmental and experimental child psychology, human ethology and physiology. The main thrust of research has concerned the expressive behaviours considered to be signals of hunger and satiety; the study of sucking behaviour and the stimulus properties that elicit changes in the sucking pattern; and the structure and function of the feeding mechanism. Since one of the reasons for engaging in this research project is to further an understanding of infant feeding so that it can make a contribution to clinical nursing practice in the United Kingdom, the survey will be confined to studies carried out in Western Society.

1.2 EXPRESSIVE RESPONSES ASSOCIATED WITH INFANT FEEDING BEHAVIOUR.

Expressive behaviours that have been associated with feeding in infants are those behaviours collectively known as oral behaviours (Korner et al., 1968; Korner 1973); fussing and crying (Wasz-Höckert et al., 1968; Bernal 1972) and various actions used to indicate satiety such as refusal to open the mouth (Dubignon and Campbell 1969). The assumption inherent in the use of the word expressive to describe feeding behaviours is that they indicate some feeling, state or need, associated with eating; that they in fact act as signals. This therefore raises a fundamental question concerning the nature of the signal. Also there is the problem of the fact that mothers have a tendency to give meaning to every response that her baby makes (Dunn 1975) so that any research incorporating a mother's account of her infant's progress is liable to be invalidated unless this is allowed for. These facts must be borne in mind when considering what is known about infant's signals regarding food intake.

(a) Hunger and Spontaneous Oral Behaviours.

The spontaneous and oral behaviours that have been described include mouthing, finger sucking, hand-to-face contacting, hand-to-mouth contacting and reflex sucking (Korner et al., 1968; Korner 1973). The early workers interested in feeding approached the study of oral behaviours in several ways. Ripin (1930) presents one of the earliest accounts of systematic observations and results from experimental studies on the infant's feeding reactions. She compared bottle feeding infants with breast feeding infants with respect to the specific feeding responses at different ages using a cross-sectional design. The specific feeding reactions were defined

as those behaviours that appeared to be directed towards the taking of food, or for the purpose of taking food, and included the oral behaviours of opening the mouth and sucking movements. Ripin, therefore is careful to point to the distinction between behaviours that are a response to many different stimuli and situations, as opposed to behaviours that are specific reactions. In the breast-fed sample, studied from birth, reflex sucking and finger sucking were observed within twenty-four hours of birth and were described as responses to accidental contact of hands on the mouth, or as spontaneous movements without any previous stimulus. It is not until the end of the first month of life that these behaviours were said to be specific to the feeding situation. In the bottle fed sample studied from one month of age, the oral behaviours of opening the mouth and sucking movements were clearly specific responses, elicited by the bib at one month but by the sight of the bottle by three months. So although present from birth, Ripin does not consider that oral behaviours become part of the repertoire of feeding behaviour until the end of the neo-natal period. Earlier, Mursell (1925) had pointed to the non-specificity of non-nutritive sucking in the very young infant and Piaget (1936) reported similar findings from observations on his own children.

Gesell and Ilg (1937), on the other hand, in their intensive naturalistic study of the feeding behaviour of ten infants, describe mouthing and finger sucking as possible indicators of hunger throughout the first four weeks of life. When mouthing, the tongue is said to be hollowed with its under surface readily visible and is frequently accompanied by half open eyes and hands at the level of

the mouth. No further reference to these behaviours in relation to hunger is made. Mouthing however is later said to FOLLOW feeding after four weeks of age, with the tongue guttering rhythmically. For Gesell and Ilg, behaviour is a response that is specific to a particular situation; feeding behaviour is thus any behaviour that is associated with feeding. Their interest lay in describing the morphology of behaviours at different ages and not in attempting to understand its causes, functions, or developmental antecedents. No attempt is made to interpret the various behavioural patterns so that the fact that mouthing appears both before and after a feed to these workers does not appear to conflict with their statement that mouthing is an indicator of hunger. Just how similar these behaviours really are must remain in question since it was not the practice of Gesell and Ilg to provide detailed descriptions such that other workers could replicate the observations; only still photographs were presented.

There is another reason why any claims regarding the relationship between hunger and mouthing must be studied carefully. That is because mouthing could simply be a consequence of some accidental pressure on the neonate's hands. Peiper (1961) reports observations on a reflex, named after Babkin (1956), that involves mouth-hand co-ordination of the young infant. During the first three months of life the co-ordination is reflected in an elicitation of reflex-mouth opening and head turning to the midline through pressure of the palms of both hands when the infant is lying in the dorsal or lateral position. The mouthing described by Gesell and Ilg might well in part include mouthing that is part of the Babkin reflex and therefore in no way can be said to represent a signal of hunger. Ripin (1930) is much more explicit about the behaviours she

describes and also recognizes the need to distinguish elicited responses from purposive behaviour, but even she does not contribute to the issue as to whether any oral behaviours can actually be said to SIGNIFY any feeling, state or need associated with feeding, in the young infant.

The subject of feeding appeared to lose its interest for research workers until the late 1950's and early 1960's. By then it was becoming clear that behaviours observed and studied in infancy either may not in fact be seen in adulthood, - or even in the older child (Kessen et al., 1961), - or they may be profoundly altered in form during the course of development (Lewis 1967). To understand the nature of individual differences in the neonatal period attention became directed towards the identification of behaviours that were essentially stable responses and behaviours that could be used as reliable dependent variables. Thus more recent interest in the neonate's oral behaviours has reflected the need felt for a more systematic consideration of each behaviour as a function of age, sex, time since feeding and as a measure of individual differences. Unlike the earlier studies, researchers now recorded the oral behaviours more systematically such that form, frequency and occurrence could be quantified. They were recorded in the periods immediately before and immediately after a feed and in between the feeds. The data collection also conformed to other standardized practices. The environment in which the observations were made was now specified and thus controlled, the frequency and duration of each behaviour was recorded according to explicit independent variables, (e.g., age, sex, time since fed,) and scoring criteria were developed for the active components of the patterns of behaviour.

Apart from Wolff (1959, 1966) in all instances inter-observer reliabilities were presented, with Korner et al., (1968) and Korner (1973) also presenting score-rescore consistencies. Science, and with it the laboratory, had 'taken over'. So what did this change bring to light?

Kessen, Williams and Williams (1961) and Hendry and Kessen (1964) studied mouthing and hand-mouth contacting in normal infants aged between one and a half hours and five days. Hand-to-mouth contacting described those responses whereby the infant brought his fingers or hands to the mouth, and mouthing included any sucking-like movement of the mouth that occurred in the absence of external stimulation. The 1961 study found that there were stable and significant individual differences in the frequency of hand-to-mouth contacting, and reliable, although not quite stable, significant individual differences in the duration of mouthing. No regular increase or decrease in occurrence over the five days was found in either behaviours, so that experience did not appear to play a part in their occurrence. More importantly for the question of their possible signal value, there appeared to be no correlation between feeding experience and the duration or frequency of the behaviours. In their earlier study Kessen et al., (1961) only scored the behaviours once each day, scoring for a five minute interval at the same time, over a five day period. The later study used different methods (Hendry and Kessen, 1964), scoring within the first five minutes but this time at the beginning of a half hour period between two consecutive feeds on two days; the inter-meal interval on each occasion was specified as four hours and thus presumably represents a scheduled feeding regime. This second study showed that the oral responses are relatively low only in the second period of observation

(i.e., about half an hour after the feed), and that it was now found that mouthing was affected by age, being more frequent at 23 hours than at 71 hours of age. It was unfortunate that Kessen et al., (1961, 1964) did not specifically analyse the relationship of these oral behaviours to hunger. But it was postulated, in passing, that if they do reflect degrees of hunger then from the results it appears that hunger is only reduced some time after the feed, when the physiological processes are complete. This suggestion raises the possibility that the immediate satiating effects normally associated with the end of a meal may be learned and that in fact oral behaviours in the early neonatal period are ambiguous signals because of this time between the physiological states of deprivation and satiety which psychological processes later come to bridge. A very early study by Irwin (1930) on the distribution of activity over the first ten days of life supports this postulation, with the finding shown that it is not until the fifth day that feeding clearly exerts an inhibiting effect on the level of activity. From these studies the fact also emerges that the occurrence of hand-to-mouth contacting is more reliable as a measure of individual differences; any claim regarding its possible value as a signal of hunger must therefore take this fact into consideration.

There is only one recent study that specifically examines the relationship between hunger and the oral behaviours (Korner et al., 1968), at ages 45 - 88 hours. Their description of oral behaviours encompassed mouthing, hand-to-face contacting, hand-to-mouth contacting and finger sucking. Mouthing was further subdivided into sucking, tongueing, snooting, chewing or reflex sucking. This time using a sampling technique combined with automatic video-recording, it was found that mouthing was indeed hunger related, but that finger

sucking, hand-to-mouth contacting and hand-to-face contacting was related to high levels of arousal and not hunger. Hunger was defined in terms of "time since last fed" and again it appears that schedule feeding was the practice of the hospital from which the sample was drawn. Subsequently Korner (1973) has reported a sex difference as well as individual differences in the frequency of hand-to-mouth contacts, with the sex difference reflecting a difference in style rather than frequency (Korner and Kraemer 1972). Girls are significantly more likely to engage in hand-to-mouth approach behaviour, where the mouth is dominant. The definition for this behaviour was that the mouth approached the hand and scoring only occurred if the mouth opened when the hand was at a distance of at least one and a half inches or more from the face. The infant's head strained forward in an effort to meet the hand. When this particular behaviour was isolated and then examined in terms of "time since last feed," in both sexes it was found to be related to hunger.

From Korner's work it does, therefore, appear to be the case that the neonate can use oral behaviours to signal hunger; but as the evidence stands, oral means specifically mouth activities if it can be assumed that a mouth-dominated hand approach is mouth-directed. As Peiper's (1961) description of the Babkin response has shown other hand-to-mouth activities may simply be reflexive behaviour elicited by environmental factors made more likely by the infant's level of arousal and activity; (Kessen et al., 1961, 1963). However, questions still remain unanswered since all the studies reported so far have used infant's who were bottle-fed on what appears to be a strict four-hourly schedule of feeding. Moreover, "TIME since the last feed" may not be a useful index for hunger under these conditions; nor

should it be assumed that breast-fed babies behave in exactly the same way as bottle-fed babies (Richards and Bernal 1972).

(b) Hunger and Crying.

Amongst the many interpretations of the young infant's cry, hunger is cited as a specific cause (Aldrich et al., 1946), and Gesell and Ilg (1937) simply assume that because crying normally occurs before a feed and ceases after a feed that crying signals hunger, a position that Peiper (1961) also presupposes in his study of the neurology of food intake. But the problem with this interpretation is the lack of concern given to the possibility that crying is a feature of a certain level of arousal which can be reduced not only by feeding but also by contact, cuddling, rocking, and gentle human voices (Kessen and Mandler 1961), continuous stimulation through a variety of modalities (Brackbill 1971), vestibular - proprioceptive stimulation (Korner and Thoman 1972) and non-nutritive sucking (Kessen and Lentzendorff 1963). It is possible, therefore, that crying is a non-specific signal that acts as a distress call to be interpreted by the receiver according to certain external factors. Indeed, the idea has its followers that crying is non-expressive (Gesell 1940), diffuse (Spitz 1965), reflexive (Osgood 1953) and carries NO meaning or intention (Sherman, 1927; Miller 1951).

However, two important studies suggest that crying is in fact more complex than some workers have suggested. The first is a spectographic and auditory analysis carried out by Wasz-Höckert (1968) and his co-workers on 351 infants aged from birth to seven months. Different cries were identified according to the situation in which they occurred. These were the birth cry, the pain cry, the hunger cry and the pleasure cry, and it was found that each cry

led to its own characteristic pattern. The birth cry has a flat, falling melody, each signal lasting about one second. It is always tense. The pain cry again has a falling melody with a high pitch and the signal is long, ranging from 1.1 to 1.5 seconds; the older the baby the shorter the cry. It is also usually tense and there is a shift in pitch. The hunger cry has a characteristic rising-falling melody with little age changes or any noticeable alteration in pitch. Finally the pleasure cry is invariably flat in form with the most variable change in pitch.

Having identified four different cries, Wasz-Hockert asked whether other groups of listeners could identify these four cries from tape-recordings. They found that this was possible but only within certain limits. The cry must be a typical cry, and interestingly, experience of infants appears to play a part in the identification of the cries; - midwives, childrens' nurses and mothers obtained the best scores.

The second study is one reported by Wolff (1969) who also used tape-recordings and sound spectrograms to ascertain whether differences of structure can be identified in crying. Wolff (1969), however, identified three rather than four distinct patterns in the neonate which he called the rhythmical cry, the mad cry, and the pain cry. The differences between the findings appear to be related to those qualities that are emphasised. The rhythmical cry is described as a low-intensity or rhythmical cry which slowly builds up to become loud and rhythmical. Wolff calls this the basic cry. The mad cry is similar apart from differences in emphasis, whilst the pain cry starts suddenly, to be followed by a pause and finally a series of gasping cries. Wolff also established that mothers could differentiate the cries but because differentiation alone

indicates nothing of the possible functional significance and signal value, he carried his argument even further. He found that there was a lack of specificity in the mother's response to the cry, particularly in her response to the rhythmical cry and the mad cry. Thus, apart from the pain cry, it was found that on the whole what determined the nature of the mother's response was her past experience. Multiporous mothers would not necessarily respond immediately, and would not always first try a feed. Primiporous mothers, on the other hand, would respond immediately and would most frequently be prepared to feed the baby at once. Interestingly, this is in complete contrast to Bernal's (1972) finding where, within the first ten days of their baby's life, it was the second mothers who responded more quickly to crying and more often by feeding.

Thus, it appears that crying does have the potential to be a signal in that differences in structure are recognized not only in the laboratory but also in real life. However, apart from the pain cry, receivers interpret the signal not according to the specific physical characteristics of the message, but according to the context in which the signal occurs, the events that have preceded it, and possibly by the age of the sender. The fact that Wolff (1969) and Bernal (1972) found such differences (even between mothers of similar parity) points to yet other possible sources that may affect practice - namely cultural practices and again method of feeding - all of Wolff's sample of U.S.A. mothers were bottle-fed, whereas in Bernal's U.K. sample there were both bottle and breast-feeders. One is still left, therefore, with the question "do young infants cry because they are hungry, even though their calls may be misinterpreted?". Wolff (1969) comes closest to answering this question.

In his study of the eighteen bottle-fed babies, he found that at four days of age babies do in fact cry more before a feed than when satisfied and, importantly, do not stop crying until fed. Not even holding will quieten them. During the second week of life, the crying is even more apparent for its signal value, since it occurs consistently with an interruption of feeding. The most vocal protest occurs when the feed is removed after the infant has taken the first ounce. The frequency of this protest continues to increase until the infant is five weeks of age, when it declines. Later crying is also used in response to new tastes. Wolff's distinction is not in his consideration of the frequency and distribution of crying in infancy; Bernal (1972) also reports findings on this. Nor is Wolff (1969) alone in considering external stimuli that inhibit crying. Brackbill (1971) studied the effect of continuous stimulation on arousal levels of 24 one-month-old infants; Korner and Thoman (1972) considered the soothing effect of vestibularproprioceptive stimulation on 40 two-to-four-day old infants during very short periods of observation (30 secs.); and Kessen and Lentzendorff (1963) have shown that non-nutritive sucking reduces crying in infants, aged between 24-60 hours.

The difference lies in the setting of the question: Brackbill (1971), Korner and Thoman (1972), and Kessen and Lentzendorff (1963) do not consider the causes of crying, nor the duration and distribution of crying, but simply study its inhibition; Bernal (1972) only reports on the duration and frequency of crying. Also, apart from Bernal (1972), all the studies are experimental and thus cross-sectional in design covering a very short span of time in the infant's life. So that whereas it is clear that crying can be reduced in many ways, it is not at all clear from these studies how effective

or long-lasting these different techniques are in real life. Only Wolff (1969) has studied the infant in such a way that the results of the responses are observed. Only then is it clear that not all techniques are always successful in elapsed times; on some occasions ultimately only a feed will comfort the infant. Nor does the infant's use of the signal remain the same at all ages; between two to five weeks of age crying is used as a form of protest to an interruption in the feed, whereas later it may be used in response to a new taste. Whether these age differences reflect a difference in the infant's capacity or simply a response to experiences considered by the culture to be appropriate for the age, is unknown. Nevertheless, according to Wolff's findings on the four-day old bottle-fed baby, CRYING does appear on occasions only to be inhibited by a feed and thus potentially does have signal value as an expression of a hunger state.

(c) Expression of Satiety.

Expression of satiety is a subject that only Gesell and Ilg (1937), Peiper (1961) and Dubignon and Campbell (1969) have considered specifically.

Gesell and Ilg (1937), from the results of their naturalistic observational study, distinguish between satiety and final satiety (refusal and rejection) with independent developmental histories. During the neonatal period the infant usually falls asleep when satiated, and if breast-feeding, the head will drop from the breast. As the infant grows the head drop becomes a voluntary act, he is more likely to remain awake and will then smile at his mother. By 16 - 20 weeks, satiety is reflected in an interest in his surroundings towards the end of the feed, and subsequently by playfulness at the

breast or with the bottle. Frank refusal and rejection, on the other hand, are not reported until after the fourth week when the infant will refuse to open his mouth or will push the nipple out with his tongue. The refusal then becomes more general and by 24 weeks will include arching the back, extending the neck to be followed by spitting out. During the second year refusal is most commonly expressed by a hand response, e.g., pushing the spoon away. It is only by then that the child is least likely to take food that he does not really want. Gesell and Ilg (1937) thus describe stages from a less to a more voluntary expression of satiety, the fundamental characteristic being that of head withdrawal.

Peiper (1961) considers satiety essentially as a negation of those aspects concerned with hunger. There is an absence of the rooting reflex and a gradual increase in the pause length between sucks. Associated with this reduction in sucking is a motor restlessness when the infant may lose the nipple or push it out with his tongue. This expression of satiety according to Peiper is, however, only suited to breast-fed babies. He suggests that whilst satiety is a response both to food intake and to fatigue, the latter is a more efficient mechanism. When no effort is required, only very large food intakes will induce satiety. Thus, because of the ease of bottle feeding, bottle-fed babies are in danger because of the possibility of greater intakes.

Both Gesell and Ilg (1937) and Peiper (1961) describe consequent behaviour, namely the effects of satiety. Peiper's description is limited to the younger infant and is less discriminating in detail. In his attempt to offer an account of the causal mechanism, he identifies two factors: food intake and fatigue.

Since no data are presented to support this speculation one can only presume that it rests on chance observation from clinical practice. Gesell and Ilg (1937), on the other hand, offer no explanation. Throughout, their emphasis lies in the collection of normative data so that the richness of their behavioural categories rests on their systematic collection of data. This apparent paradox of data without explanation vis-a-vis explanation without data reflects the swing in the approaches to developmental questions during the two periods represented. Some of the early workers interested in children were painstaking in their data collection of behaviour in its natural setting (e.g., Shirley 1931; Bayley 1933; and McGraw 1943), whilst those of a more theoretical persuasion engaged in speculation without a systematic study of possible hypotheses, (Piaget 1936; Mursell 1925; Spitz 1945; Freud 1910). In fact this lack of concern for satiety as a signal seems to have arisen because it was lost in the primary consideration of that time - i.e., that of oral gratification of the need to suck. Hunger and the need to suck were studied and theorized about but satiety as a behaviour in its own right was given scant attention. (Weinfeld (1950)exemplifies this point).

It was not until 1969 that Dubignon and Campbell separated out the various factors involved. They achieved this through the measurement of the different components of sucking in the three - four day old bottle-fed infant. What they found was that fatigue and satiation have separate effects, but NOT on sucking, with satiation independently expressed by refusal of the bottle. These workers, therefore, suggest that if expression of satiety is to be used as an index, refusal to accept food and not sucking

patterns is the more reliable measure to score. But this presumes that neonatal infants can regulate intake and that this regulation is independent of effort. Dubignon and Campbell (1969) found that regulation was by volume rather than calorific value, yet Peiper (1961) raises a doubt about the efficiency of volume as a regulatory mechanism. From Gesell and Ilg's observations of behaviour in the natural setting, there is some support for Peiper. Frank refusal was not observed until after the fourth week of age. Satiation in the neonatal period was represented by the infant falling asleep and thus possibly by FATIGUE. The confounding factor in Dubignon and Campbell's study is the lack of data on intake other than at ONE feed. This is really no test of the infant's ability to regulate over a period of time, which is regretted since Peiper's speculation is not supported by any serious study of bottle feeding, in contrast to that of Dubignon and Campbell (1969). One can only conclude this section with the suggestion that neonates do stop feeding of their own volition in the natural setting, but it is not clear whether this is anything more than cessation by falling asleep.

1.3 FEEDING BEHAVIOUR OF THE NORMAL HUMAN INFANT AT BIRTH.

Prechtl (1958) states that the newborn human infant has a fully developed repertoire of behaviour patterns associated with feeding at birth. He divides these patterns into four components:

1. Side-to-side movements of the head or a single directed turning movement which provides an opportunity for the mouth to come into contact with the nipple of the breast.
2. Opening of the mouth and grasping with the lips, a co-ordinated pattern elicited by a tactile stimulus

occurring on the lips or the immediately adjacent areas.

3. Sucking movements produced by tactile stimuli anywhere in the mouth area, but more effectively inside the mouth.

4. Swallowing movements released by the presence of milk in the mouth

On closer examination these four components appear to reflect a distinction between those behaviours that seem to be concerned in orientating the infant to the food source, and those behaviours responsible for the subsequent consumption of food. In exploring the capacity of the human infant's feeding repertoire a first step therefore is to describe the nature of these two separate activities.

(a) The Mechanisms of Infant Behaviours Related to Orientation to a Food Source.

Prechtl examined in detail the orientation movements of the baby's head and mouth. He describes four movements:

1. Side-to-side movements of the head either when the infant is lying on his back or his stomach. Each turn lasts about two seconds and there is a rest in the lateral position of about one to three seconds after the next turn occurs. It is a response to tactile stimulation on a large undifferentiated area of the skin around the mouth and lip.

2. The pendulous orientating response, quick rhythmical movements of the head to bring a tactile stimulus that originally touched the lip mucosa on one corner of the mouth so that the stimulating object is in contact with the whole inner side of the lips. A strong grasping forward movement is then released.

3. The directed head-turning movement, is in response to a tactile stimulus on a highly differentiated area of the skin immediately adjacent to the corners of the lips. The head may only turn towards the stimulating object or the turn may be followed by a grasp of the object with the lips, depending upon the strength of the stimulus.

4. The lip-protruding response occurs when the area around the mouth is stimulated in the baby who is fully awake.

Following a careful qualitative and quantitative analysis of these four responses, Prechtl reports that apart from the directed head turning all can be observed in the full term infant at birth and are present in the pre-term infant. The directed head-turning movement usually occurs at two to three weeks after birth and is arrhythmic searching as opposed to the rhythmic non-direct rooting of the side to side movement. This latter movement is described as a stereotyped response because it was always similar in form despite the nature of the stimulus or the area of stimulation. It only varies in frequency or amplitude. The directed head-turning movement, on the other hand, also varies in form according to the position of the stimulus. Prechtl likens this latter movement to a taxis (Hinde 1966) because of this property for spatial orientation. Both external and internal factors regulate its presence. It does not occur during defaecation or micturition, nor when the baby is yawning, crying intensively, or engaged in sucking movements. Factors that facilitate its response are the state of hunger (defined in terms of 'time-since-last-fed'), waking state, immediately preceding flexion reflex or startle reflex, and the posture of the head and arm. This directed head-turning movement is stronger when the arm on the stimulated side is held up, whilst

the quickest response is obtained when the head is turned to one side and the opposite corner of the mouth to that direction is stimulated.

Peiper (1961) has reviewed the literature on the rooting reflex, reporting many earlier but less detailed descriptions of the various movements, the earliest being that by Pepys in 1667. From Prechtl's careful study in 1958 it is now clear that rooting behaviour is not strictly unitary. Four different movements can be identified, and two change in character during the first two weeks of life. All are present in infants born with severe congenital brain malformations, e.g., mesencephalic monster, suggesting that the rhombencephelon alone is able to produce these movements.

(b) Basic Physiological Mechanism of Sucking and Swallowing.

The anatomical apparatus for sucking comprises two lips and cheeks, the gums, the hard and soft palates, the uvula, the tongue, the suction pads, the mandible and the mucosal lining (Gesell and Ilg, 1937). As Bosma (1967) states, we have present a highly organised perceptual-motor structure. The level of development at birth is remarkable; it is clear, particularly from the detailed descriptions of Halverson (1944, 1946) and Peiper (1961) that sucking is not simply a reflex in response to a variety of external stimuli but a complex behavioural system involving sucking, breathing and swallowing. The organisation of this system has been studied using either cinemato-radiographic equipment (Ardran, Kemp, and Lind, 1958 (a) and (b); Bosma, 1967) or the simultaneous tracing of sucking and breathing, breathing and swallowing, and sucking and swallowing, by fixing a rubber bag under the infant's chin (sucking record) and to the infant's abdomen (breathing record) and placing the hand on the infant's larynx to

record swallowing. (Peiper, 1961).

Evidence from Gesell (1940) suggests that free swallowing and sucking begin between the 32nd to 36th week of foetal life, although Humphrey (1964) considers that such movements can be elicited in the 29 week old foetus. The question therefore arises as to what conditions promote the synchronization between sucking, swallowing and breathing, since this must take place for feeding to be successful. Halverson (1944, 1946) and Peiper (1961) both agree that in good feeders these activities are well co-ordinated, and occur when sucking and swallowing form a recurrent rhythmic unit, with breathing so adjusted that it does not interfere with sucking. The behaviour seen is a concurrent appearance of regular breathing and sucking, with swallowing occurring immediately after one or two sucks and at a natural pause in breathing. How this co-ordinated behaviour pattern is achieved is less easy to establish. Peiper (1961) assumes that the essential element is regularity in breathing and sucking sequences, with breathing rates adjusting to the sucking rates. Halverson (1946), however, considered this not to be the whole story. Not only must the breathing activities become adjusted to the sucking, but this adjustment requires certain pre-conditions:

> "The breathing movements must be relatively slow and smooth and the pauses between movements brief. The sucking movements must be relatively slow, relatively weak or only moderately strong, and sucking power smoothly applied".

It also appeared from these early studies that the ability of these various activities to be co-ordinated is certainly present at birth and may well be functional preterm (Halverson, 1946).

Thus, from these early detailed observations it appears that feeding as a complex behavioural system depends for its success upon the duration of the suck rather than the frequency or strength of the

suck per se. The most successful feeders in Halverson's (1946) sample had sucks of at least four seconds duration, and the strength of suck was increased gradually rather than being applied immediately. Neither Peiper (1961) nor Halverson (1944, 1946), however, consider the possibility that the food may affect the pattern of behaviour. Johnson and Salisbury (1975) indeed suggest that the type of food may well influence the degree to which sucking, swallowing and breathing are co-ordinated. They found that the frequency of breathing was slower when the newborn baby (birth - ten days) was fed cow's milk than when it was fed with breast milk. Saline, on the other hand, caused choking particularly if given within the first 48 hours after birth.

A further understanding of this complex behavioural system requires an analysis of the sucking mechanism. Halverson (1938), in his historical review of the sucking literature, reported that the early workers illustrated clear developmental trends in sucking ability, changes occurring in both the means used and the power achieved. Both Auerbach (1888), reported in Halverson (1938), and Gesell and Ilg (1937) show that initially the lips act by closing the mouth and compressing the nipple. Then the tongue and lower jaw are depressed so that the oral cavity is increased but the air pressure reduced. It was thus considered that the consequent downward stroking of the lower jaw and subsequent induced negative pressure played the major role in sucking during infancy. The developmental changes involve the declining role of the lower jaw (at about two-three months of age), replaced by the use of inspiration to achieve the sucking pressure - the latter difference being thought to result from a change in the shape of the mouth as the child grows.

The sucking pressure of the infants was studied separately; Halverson (1938) reported findings showing that breast feeding requires more forceful sucking than bottle feeding, and that sucking power increases with age. It was therefore suggested that effective breast feeding is not possible immediately at birth. Recordings of pressure during bottle and breast feeding provided the source of raw data for these early studies. Recently, however, through the more sophisticated technique of cine-radiography, it has become apparent that even the sucking mechanism is not a unitary behaviour. Sucking at the breast is not the same as sucking from the bottle (Peiper, 1961). The infant obtains milk from the breast not solely by creating a negative pressure but also through a stroking or milking action of the tongue on the nipple (Ardran, Kemp and Lind 1958b); he must, therefore, have the whole sucking cone in his mouth. Nor is this all. Suction alone apparently will not get the milk; it is thought that the milk secreted into the alveoli of the breast has to be actively propelled from the alveoli to the nipple by the mammary gland, (Isbister, 1954).

The mechanism of bottle feeding, on the other hand, is principally that of sucking and pressing. The milking action plays only a minor role; (Ardran, Kemp and Lind 1958a; Bosma, 1967). Other differences lie in the relative ease with which milk is sucked from the bottle, and the uniformity in the flow, (Peiper, 1961). Kaye, (1967) in his review of sucking behaviour identifies further sources of doubt. Colley and Craemer (1958), using a different approach to that of Ardran, Kemp and Lind (1958a) - namely a measure of pressure within and surrounding the teat - challenge the role of the tongue's stripping action. For them, negative pressure plays the crucial role

in sucking. But since the studies used infants of different ages the role of experience could well have been the mediating factor; Colley and Craemer's sample was of infants aged from five to thirty-five weeks, whereas Ardran, Kemp and Lind used newborn babies. Kaye (1967) also reached the conclusion that no study to date had satisfactorily estimated the sucking pressure exerted, since in the early studies no distinction was made between background pressure and pressure exerted from the suck. More recent studies have not considered such factors as the size of the hole in the nipple (or the rate of flow), the shape of the nipple and its flexibility. As to whether Ardran et al., (1958) or Colley and Craemer (1958) is right, probably both are correct. Sameroff (1968) has shown that by three days of age infants can use both components according to the nutrient delivery system.

In summary, therefore, it appears that for the infant to be able to feed, there must be close co-ordination between sucking, breathing and swallowing. The key factor is, possibly, the duration of the suck, but the role of the breast milk in eliciting the components to function in feeding has not yet been fully explored. The sucking mechanism consists of two actions, the production of negative pressure and a stroking or milking action of the tongue, whilst the behaviours that appear to enable the infant to establish feeding are collectively described as the rooting reflex.

(c) Studies Concerned with the Factors that Control Sucking Behaviour.

In the quest for an understanding of the newborn infant's feeding behaviour the next stage is to identify the functional capacity at birth of the various components of the feeding system. For feeding behaviour to function as a reliable means of satisfying food needs, it

must have the ability to regulate a safe, non-poisonous and nutritious intake to meet these needs. The question, therefore, posed is 'how far developed is this system at birth?' In order to attempt to answer this question two areas will be covered. The first concerns taste perception (Gibson, 1967), and the second the extent to which the newborn sucking mechanism can be modified such that it can be said to adapt to internal or external changes. The studies to be reviewed do not fall exclusively into one category or the other; through differences in interpretation they are used to contribute to both areas.

(c)(i) Perceptual Mechanisms Related to Feeding.

A perceptual system is concerned with the selection of information from the environment. For the newborn during feeding, information is available from the object delivering the food and the properties of the food itself. It is important, therefore, that in describing the smell, taste, and tactile perceptual systems, the various sources of information are properly controlled. Studies concerned with the role played by the object sucked include the size, shape or compressibility of the sucking device. The basic question concerns a precise definition of the actual dimensions of a nipple that elicit optimal sucking performance. An early view of the relevant parameters suggested that the critical feature is the protractibility of the nipple, that is, the ease with which the baby can draw the nipple far into the mouth (Ogden and Mackeith, 1955). Gunther (1955, 1958) analysed sucking at the breast and showed that unless the nipple fills the baby's mouth right to the palate and the dorsum of the tongue, the full sucking action of the jaws, tongue and cheeks is not evoked. This led her to postulate that the shape of the nipple acted as a sign stimulus or 'sign release stimulus' in the sense that

Tinbergen (1951) describes the properties of an innate releasing mechanism on an innate pattern of action.

It, therefore, looked as though the justification for the protractibility view lay in the need for there to be a match between the shape of the nipple and the sucking action. Further support for this position came from the cine-radiographic studies on sucking by Ardran et al., (1958a), who considered that the rigid commercial nipple used in bottle feeding was less successful in promoting feeding. Peiper (1961), however, presents observations from which he concludes that the infant actually prefers the rubber nipple and that it therefore acts as a 'supranormal object' in Tinbergen's sence (1951). In his review of the literature Peiper shows that artificial nipples of varying forms and shapes are equally effective feeding devices. Yet is 'effective' the same as 'optimal'?. The early studies unfortunately cannot provide any 'answers' since they did not include the separation of the effects on sucking of the different parameters of the oral stimuli.

More recent experimental analysis has been directed precisely toward this problem. Lipsett and Kaye (1965) showed that contour and texture are probably important parameters as neonates sucked only half as frequently when presented with a rubber tube $\frac{1}{4}$" in diameter as compared with a standard artifical rubber nipple. Dubignon and Campbell (1968b) further analysed the possible parameters involved. They showed that both size and compressibility affect the sucking response. Softer tubes elicit more sucking than harder tubes, and nipples more than any of the tubes, with the largest tube eliciting the least number of responses of the variously sized tubes(1/4", 1/2", 11/16" diameters). Both of these studies,

therefore, show that the quality of the object placed in the mouth of the three to four day old infants affects the sucking response. Unfortunately, however, neither study explored the possible effect that the nutrient may have on the responses obtained as in all cases a blind nipple or tube was presented. It is not, therefore, shown whether these physical effects are over-ridden when there is fluid in the mouth, or by taste stimuli and any temperature cues provided by the nutrient. Nor, (as Dubignon and Campbell (1968b) have pointed out), is it clear whether the performances obtained in the non-nutritive situation and when the babies were lying in their cots, can throw any light on actual sucking during feeding when the baby has other tactile stimulation from the support and bodily contact provided by the mother or mother-substitute. In terms of the mouth as a tactile perceptual system it is thus clear that differences in the physical quality of objects can be detected and responded to. The way that these differences are used in order to regulate feeding is not known since the two experimental studies used non-nutritive sucking as the dependent variable. Wolff (1968), whilst not directly pursuing this problem, found that the physical properties do not affect the rhythmical properties of sucking, but possibly affect the amplitude.

Studies examining the ability of the infant to perceive taste, are directed towards the ability of newborn infants to recognize differences in the taste of nutrients (Jensen, 1932; Kron Stein, Goddard and Phoenix, 1967; Nisbett and Gurwitz, 1970; Desor, Maller and Turner, 1973; and Engen, Lipsett and Peck, 1974). Jensen (1932) first showed discrimination of sugar and salt by newborns, but he was unable to demonstrate differential responding to milk, glucose or water solutions. He recorded the number of sucking responses within

a ten-second period to a variety of solutions. More recent evidence, using more sophisticated techniques, suggests, however, that this earlier finding may not in fact represent the true capacity of the human newborn. Kron et al., (1967) found that one - two day old infants responded very differently to a milk formula and a 5% corn syrup. On the first trial there was an increased rate of sucking to the milk formula, but over a period of time there were significant increases in the rate of sucking to corn syrup, but the rate for the milk formula remained the same. Dubignon and Campbell (1969), using a milk formula and a 5% dextrose solution found that on a partial reinforcement schedule for two minute sessions, three to four day old bottle-fed infants differentiated between the two solutions in the frequency and time spent sucking but not in the amplitude of sucking nor in the expression/suction ratio. But to discriminate between salt, sugar, milk and corn syrup might be said to reflect only a very crude capacity to taste differences between solutions offered. Several workers have shown that in fact newborn infants (aged between one to four days) have a more adaptive taste perceptual system than this. Nisbett and Gurwitz (1970) have shown that newborns can in fact detect differences in the sweetness of (lactose versus glucose) standard formula Enfamil 20 (Mead Johnson). Desor, Maller and Turner (1973) refined the experimental technique and showed that sweetness per se can be discriminated (glucose, fructose, lactose and sucrose) and Engen, Lipsett and Peck (1974) supported this latter finding but only tested the discrimination between glucose and sucrose. All the workers found that differences in taste resulted in differences in intake.

It seems, therefore, that in terms of the classical sensory

qualities of taste, newborn infants can distinguish between salt and sweet solutions. What, however, does this tell us about the competance of the infant's taste perceptual mechanism? Gibson (1967) considers tasting as a perceptual activity that uses information about the consistency, texture, relative temperature and the odourous components of nutrients as well as the sapid component. He, therefore, considers that it is this perceptual system that controls ingestion and that this is done by the selection of certain foods and rejection of others. If regulation is expressed through taste-perception in this wider sense, then studies on discriminations do not yield information about the infant's perceptual capacity. Nor does discrimination reflect the functional capacity of taste in the newborn. Although all workers were interested in amount consumed, only Dubignon and Campbell (1969) and Nisbett and Gurwitz (1970) used an entire normal feed as the dependent variable. It could be argued that taste preferences may alter during the course of the feed, so that the study of discrimination and preference, even at the start of the feed, says nothing about the subsequent place of taste in terminating the feed. No study has adequately examined this factor. One is left, therefore, with the knowledge that human newborns can discriminate between salt, various sugar solutions, milk formulae and milk formulae of different sweet concentrations. None of the studies introduced controls for consistency or texture of the nutrients, so that how all these components are selectively effective or together functionally significant during the course of natural feeding, is not known.

Also, largely left unexplored, is the possible influence of hunger on the infant's response to these factors. Kaye (1967) reviewed the literature on the role of hunger as an influence on

sucking and indeed concludes that hunger (operationally defined either as food deprivation or stomach loading) does affect the amount of sucking per se; but the sucking rates studied concerned sucking on a blind nipple when no nutrient was available. Unfortunately, this does not add to our understanding of the function of taste perception during a feed because this was not studied, and, importantly, because it is now clear that non-nutritive and nutritive sucking demonstrate different patterns of response, and must, therefore, be treated as different behaviours; (Piaget, 1936; Dubignon and Campbell, 1968a; Wolff, 1968; and Bosack, 1973).

(c)(ii) Modifiability of Nutritive Sucking in Human Neonates.

In order to consider the ways in which nutritive sucking behaviour can be modified in the newborn, it is necessary first to establish what possible variations of the response there can be. Extensive studies of the neonates sucking behaviour during a feed have been carried out by Balint (1948 (a)(b)); Peiper (1963); Wolff (1968); Dubignon and Campbell (1969); Kaye (1972); and Bosack (1973). From the sucking record, five measures are considered important: the sucking count, time spent sucking, sucking rates, amplitude, and expression/suction ratio. Dubignon and Campbell use the expression/suction ratio as a means of describing the sucking mechanism, and the count, rate, time and amplitude measures as a means of comparing differences between the form of the behaviour. Sucking behaviour has, therefore, a complex structure at birth with a capacity for variation in the strength and the temporal organisation of the components.

Using these different components, Dubignon and Campbell first examine the effects on sucking of differences in nutrient.

From Table 1.1 it can be seen that infants will spend more time sucking from a bottle for milk than for a solution of dextrose, and thus produce a higher sucking count despite a slower sucking rate.

TABLE 1.1

Mean Sucking Counts in Dextrose v. Milk Feed Situation

Measure	Non-Nutritive Trial	Dextrose Trial	Feeding Trial	F
Sucking Counts (in 90 seconds)				
Suction Count	79.4	70.3	74.2	1.55
Expression Count	85.4	72.7	83.0	4.50*
Time Spent Sucking (in 90 seconds)				
Suction Time	50.7	55.8	64.3	7.28**
Expression Time	54.9	56.3	69.5	14.06***
Sucking Rate (per second of actual sucking time)				
Suction Rate	1.55	1.26	1.16	78.99***
Expression Rate	1.54	1.30	1.21	56.94***

* $p < .05$; ** $p < .01$; *** $p < .001$

(Adapted from Dubignon and Campbell, 1969).

Support for the effects on sucking of differences of the nutrient comes from Kaye (1972). He reports a difference in the burst-pause pattern of sucking in breast fed infants between the first two days and after the third day and proposes that this change results from the change from colostrum to milk that normally occurs over this period.

But a problem arises when attempting to interpret a change in the burst-pause pattern. As has been pointed out (Dubignon and Campbell), the burst-pause pattern reflects the temporal organisation of sucks and, therefore, a slower rate does not necessarily signify a change in the actual rate of sucking during the total

sucking time. Rather it is more an indication of the TIME SPENT sucking. This is an important distinction since studies have confused the two measures (Bell, Weller and Waldrop, 1971).

Other factors can affect measures of sucking during a feed. It appears that in the last quarter of the feed infants spend less time sucking and reduce the amplitude of their suck. This, not surprisingly, also results in a change in the burst-pause pattern such that what is actually seen is an increase in the pause time (Peiper, 1963; Wolff, 1968; Dubignon and Campbell, 1969) towards the end of the feed. In addition to these differences in the burst-pause pattern in response to a change in nutrients or the time of the feed, it appears that the source itself may also affect the pattern of sucking. Kaye (1972) has shown that during breast feeding sucking is continuous for the first few minutes and is then followed by a burst-pause pattern, whereas bottle feeding is generally characterised entirely by burst-pause sucking unless the teat is very fast. Earlier, Halverson (1938) had reported similar findings, whilst Dubignon and Campbell (1968a) also noticed differences in sucking count as well as rate.

Interestingly, despite the considerable amount of variation in sucking behaviour during a feed, there are stable components within an individual. Kron, Ipsen and Goddard (1968) report that the consistent measure is the sucking pressure and it is this that provides the principle information about individual differences. It is also interesting to note in passing, that, when consuming milk, newborns appear to be less readily influenced by such factors as experience, depletion of energy sources and such perinatal factors as the course of labour, the form of delivery (Kron, Stein, Goddard and Phoenix, 1967) and the type of analgesia (Kron, Stein and Goddard, 1966).

What we have, therefore, is an example of the newborn's capacity to vary components of sucking, showing an ability - even at birth - to respond differentially to a variety of possible cues. But what of the factors that control these changes? Dubignon and Campbell argue that intra-oral stimulation, satiation and fatigue are all involved but that there are interesting differences. From their work it appears that intra-oral stimulation controls the sucking rate, whereas satiation (through volume control) and fatigue, control the probability of sucking. But since these studies were mainly carried out under laboratory conditions, it cannot be said with any certainty whether infants would adapt in the same way to an actual feeding situation. Kaye (1972), who did study feeding under natural conditions, proposed that the burst-pause pattern of sucking depends upon the flow of milk. Above a critical level the infants suck continuously, but below a critical level they suck in the burst-pause style. No study has yet reported on the critical rate of flow, nor are there any naturalistic studies concerned with satiation and fatigue. Whatever the eventual outcome, it is nevertheless clear even from the studies reported so far, that the microstructure of sucking is a rich source of information regarding the infant's state, but that when unravelling the possible influences, the form in which the measures are recorded plays a crucial role.

Levels of arousal and hunger are also factors that have been studied in terms of the role they play in modifying feeding behaviour in the human newborn. In this context, hunger is a concept that is most frequently defined in terms of stomach loading (Jensen, 1932; Kaye, 1967; and Bridger and Birns, 1968). As Kaye points out, the other possible measure of 'time since feeding' has not been so well

controlled. Arousal, on the other hand, is a concept that has been more difficult to define, particularly when studying the newborn. It is used to describe different levels of alertness and activity within the infant, and the levels are said to vary from regular sleep, irregular sleep, drowsiness, waking to crying; various scales have been developed and are available in the literature (e.g., Wolff, 1966; Brazelton, 1973). Much of the research in this area has been aimed at attempting to discover the degree to which sucking behaviour is independent of hunger through the manipulation of general levels of arousal. Resulting from this, hunger has been studied through its absence (namely, as the opposite to satiety), and levels of arousal are varied at different stages following food intake, showing that sucking will occur in the satiated infant, (Jensen, 1932; Bridger, 1962; Levin and Kaye, 1966). From this it is concluded that the results establish a relationship between sucking and level of arousal. Early workers, however, did suggest that there was a positive relationship between sucking and hunger (Jensen, 1932; Halverson, 1944), but, following these studies and in particular from their own work, Bridger and Birns (1968) suggest that the influence of hunger upon sucking is only indirect, acting rather through its effect upon the level of general excitation; sucking would thus be dependent upon the state of arousal and not on the state of hunger. Assessment is problematic because a number of different measures were used to assess the level of arousal, e.g., changes in heart rate, skin conductance, or general levels of activity, and it was difficult to control all the relevant feeding factors. (Jensen, 1932; Bridger, 1962; Levin and Kaye, 1966). But, most importantly, sucking scores used to measure effects were

non-nutritive sucking rates, so that whilst hunger and arousal levels were indeed altered, the interaction between these two states upon subsequent nutritive sucking was not actually considered. Since it is argued that non-nutritive and nutritive sucking are different behaviours (Piaget, 1936; Dubignon and Campbell, 1968a; Wolff, 1968), it remains unclear from this work just how hunger and level of arousal are related to nutritive sucking in the newborn. Bell and Haaf (1971) have recently questioned the view that states necessarily have any pervasive effects on the behaviour of the newborn. They used a test of motor response (prone head reaction), non-nutritive sucking, and reaction to the removal of a nipple, and found little correlation between the degree of the response and the state of the infant. An earlier report by Bell (1966) found, following an anthropometric assessment, that breast-fed babies exhibited higher levels of arousal than was the case with bottle-fed babies. This possibly suggests a causal relationship between arousal and hunger but in the opposite direction to that proposed by Bridger and Birns (1968). It rests on the assumption that at three days of age, breast-fed babies are hungrier than bottle-fed babies because of the late onset and low volume of the mother's milk on day three. Indirect support would appear to come from the work of Kleitman (1963) on sleep, who proposes that newborns are only awake when hungry. But the relationship between hunger and sleep-wake cycles is equally unclear. Gauensbauer and Ende (1973) examined this relationship by comparing the sleep-wake cycles of demand-fed and schedule-fed infants of one - three days of age (Bottle feeders). Whilst they found that under both conditions most of the fussy-crying occurred in the fourth quarter just before a feed, the distribution of wakefulness was

unevenly distributed. In demand-fed infants the length of the cycles were positively correlated with the amount of milk taken, and the longest period of wakefulness also occurred in the fourth quarter just before the next feed. But in schedule-fed infants this was not the case. Longer periods of wakefulness occurred just after the feed and this was not correlated with the amount of food taken. Nor was the cycle-length correlated since it was, by definition, controlled by the clock. Attentive wakefulness in satiated infants who were schedule-fed has also been observed by Wolff (1966). As Gauensbauer and Ende (1973) argue, it suggests that in the newborn the sleep/wake pattern is independent of the gastric cycle; waking is not solely determined by hunger.

Sucking reflects a complex behaviour over which the human newborn has considerable control. The result is a structure that varies in marked ways according to such independent factors as the nutrient, the rate of flow, satiation and type of feed. How sucking is actually organised in the natural setting of feeding is, however, less well understood despite the large literature. The organisation of feeding in the general regulation of behaviour is also an area that warrants further study. It also seems likely that, contrary to earlier views, the sleep/wake cycle and the gastric cycle are in fact independently organised at birth.

1.4 THE DEVELOPMENT OF FEEDING BEHAVIOUR OF THE HUMAN INFANT.

The repertoire of behavioural components that have now been considered include signals expressing hunger and satiety; actions orienting to the food source; taste perception and tactile perception operating during feeding; and the structure and function of the motor system concerned with food intake, namely nutritive sucking. It

would seem natural to assume that a review of the literature on the development of feeding behaviour would be able to include a full discussion of studies that were concerned with understanding the changes in the organisation of these basic components. Unfortunately, despite the fact that feeding behaviour has been a constant explanatory tool in developmental theories (Freud, 1910; Piaget, 1936; Sears, Maccoby and Levin, 1957) there has been surprisingly little study of infant feeding behaviour beyond the first two weeks of life. This section of the review will, therefore, by necessity, be short and uneven in presentation.

(a) Development in the Skill of Feeding.

Gesell and Ilg (1937) in their descriptive study of feeding behaviour outline the main changes in behaviour that occur during the first two years of life. They present a catelogue of events which incorporate changes in expressional behaviour, oral behaviour, head behaviour and manual behaviour (see Appendix I for a summary of the main trends). Explanation for the changes in the feeding ability of the infant is said to result from growth within the neuro-motor system; a maturational theory of development. There is no attempt, therefore, to consider any other possible developmental processes and Gesell and Ilg do not provide precise definitions of behaviour and their possible antecedents. Nor do they consider whether performance of certain aspects of the repertoire is essential for the emergence of the next stage, or which aspects of the environment are essential for promoting development other than in a very general sense. As Bower (1974) has argued, temporal succession of behaviours does not imply a causal relationship; (further criticism of maturation in the exploration of motor development is reviewed by Connolly, (1970)).

All that we can conclude from Gesell and Ilg is that sucking, spoon feeding and cup feeding are all skills that have a developmental history such that the infant's ability increases with age.

As to the problems involved, Bosma (1967) outlines the anatomical and muscular changes that occur in the mouth of the infant. In the newborn infant the tongue tip and the lower lip are opposed and thus dorsally and ventrally together during sucking. The incisor ridge seldom emerges from between the tongue and lip. During the first few months of life, however, both the lower and upper incisor ridges increase in size so that the nipple or teat can now be bitten rather than simply squeezed following this change in anatomical arrangement. Post-natal development also involves other structures. There is differential enlargement of the pharynx, and the mandible becomes more stable. The tongue descends and as there is also a vertical enlargement of the oral cavity, the tongue no longer has diffuse contact with the hard palate so that now there is an open masticatory space. At the same time, there is diminution of the adipose tissue in the cheeks thus allowing further mobility of the lips, producing changes in the relative position of the upper with the lower lip. Parallel motor development allows for stabilization of the various mobile structures with ensuing functional autonomy of tongue, lips and mandible. Bosma concludes from these findings that biting and chewing are not continuous with sucking but are, therefore, new and alternative functions of the mouth. Just how the organisation of sensory experience develops remains unclear.

The approach to the development of motor behaviour using a psychological analysis is, currently, a growing area of interest. Presentations of research in this field are provided by Connolly (1970); yet, unfortunately, motor skill acquisition in feeding

behaviour is not included. Connolly (1974) only illustrates the nature of the problem when discussing the eye-hand co-ordination required by a three-year-old to open an egg. We have to go back to the very early study by Ripin (1930) who did attempt to consider the developmental processes involved in feeding behaviour, although skill-acquisition was more presumed than explored. Bottle feeding and breast feeding were analysed, but using rather different methods. In breast feeding (using infants from three days of age to three months) it was found that during the first week of life the infant has to learn to take the nipple between the lips, suck and swallow and drink without interuption and, at the same time, not hinder the process by closing his mouth at the wrong time, turning his head away, sucking his finger or falling asleep during the feed. What Ripin essentially describes as skilled breast feeding is the successful integration of the orienting movements with sucking, to provide a complete feeding act. This she called a specific feeding reaction which included "sucking, turning the head towards the breast, specific responses to touch on the face, seeking with the mouth, grasping the mammilla between the lips, and a quiet behaviour favourable to the course of nursing". The age at which this is achieved varies; in some infants the behaviours are integrated by the ninth day (13%) whereas in other infants integration is not completed until two months (15%). One further step is observed by Ripin, namely the ability of the infant to take the nipple independently. The earliest occurrence observed was early in the second month and all infants could achieve this by the age of two months fifteen days.

Ripin then examined those aspects in the feeding environments to which the breast-fed infant responded with specific feeding

actions. Smell and physical contact occurring as part of the normal situation appeared not to be responsible on their own. Rather it was a combination of the nursing position, the movement that initiates it and the physical contact with the mother; global differentiated appreciation as to what is the feeding situation.

Ripin's study of bottle feeding concerned infants aged between one and six months. She found that the earliest stimulus to produce the specific responses was the application of the baby's bib; it was not until four months of age that infants actually recognized the bottle visually as the food source (Piaget's observations (1936) are in agreement with these findings). Ripin also examined the effect of hunger on the specific responses. She found that whilst hunger did make a difference, it hindered the specific responses before five months after which it promoted them. The specific feeding responses associated with bottle feeding comprised opening of the mouth, turning the head to the side, sucking movements, grasping movements in the direction of the bottle, attempts to put the bottle in the mouth, and impatience, or quietening down, on sight of the bottle.

Three stages in the development of infant feeding thus identified by Ripin were as follows: -

Stage I (Birth to approximately ONE month).

Infant takes no active part in the feeding process beyond sucking and swallowing; losing hold of the mammilla is accidental and due to lack of skill. Movements are spontaneous rather than adjustive. Hunger and feeding reaction are not associated at this stage.

Stage II (Approximately ONE month to THREE months).

Infants are now capable of reacting specifically to the feeding situation; and breast-fed infants can take hold of the breast

themselves. They respond to the combined stimuli of posture, movement that places them in that posture, and physical contact of the mother. Bottle fed infants respond when the bib is put on.

Stage III (THREE months to...(only observed up to SIX months)).

Bottle fed infants respond specifically to the sight of the bottle, and it is not until four months of age that hunger begins to motivate learned feeding reactions.

Ripin proposed that until Stage III, all the behavioural responses can be explained simply in terms of conditioning and associative transfer. Only in the third stage can the infant be said to manifest expectancy. The nature of learning in Stage I and Stage II includes learning to respond appropriately as well as learning what to respond to: the infant learns how to react and when to react, with the former relating to skill acquisition and occurring BEFORE the latter.

Piaget (1936) disagrees with the age at which infants are capable of responding to the feeding situation. He observed that his son Laurent was able to do this by ten days. His explanation for the difference lies in the nature of the care-taking activities. He proposes that the reason why Laurent only sucked when in the nursing position was because only then was he free to suck. When in the crib he was crying, and when carried to the mother he was absorbed by the rocking motion. There is support for this latter suggestion from work with two to four day old infants (Korner and Thoman, 1972).

Wolff's study on crying (1969) provides results that further complicate any appraisal of limited ability ascribed by Ripin (1930) to the infant during Stages I and II. Wolff studied a group of 18 bottle fed babies in the natural home setting, to consider in part

the expressive role of crying in feeding. It was found that whereas crying is initially used to express hunger and in a specific sense, it is later used in response to the taste or texture of a food. Four-day old infants cry more when hungry than when satiated, and during the second week of life will respond consistently to an interruption of the feed by crying. (The most vocal protest occurs when the feed is removed after the infant has taken only one ounce). This behaviour occurs consistently until the fifth week of life when, unless the infant is very hungry, this response drops out. Wolff (1969) also reports that with the introduction of mixed feeding during the fourth week, whilst cereal produced grimacing and subsequent crying when it was tasted, purée fruits left the infants quietly expectant. Wolff postulates that the crying and fussing either heralds the first example of a taste preference or may express a frank dislike.

The protesting evident by two weeks of age does suggest that infants are capable of actively responding to aspects of the feeding situation and that this is motivated by hunger. Equally the taste preference (or frank dislike) expressed during the fourth week provides evidence of a specific response to a selective aspect of feeding, namely the taste of food. Piaget also questions the passive role given to the infant during the early months by Ripin. He points out that Ripin has ignored other elements of the infant's activities during feeding, such as the limbs which become rigid and the clenched hands. Piaget's explanation for change in feeding behaviour is that the infant slowly acquires the ability to respond appropriately to the feeding situation through gradually increasing his ability to organise his sucking schema. It is not, simply, that signals

are mechanically imposed on the sucking reflex which then assumes the ability to control the response; the infant has the capacity actively to adapt his sucking to different factors in the environment and thus feeding behaviour is a result of a differentiation of the non-specific behaviour of sucking. Piaget adopts this position because it allows for explanation of responses that are not always exactly the same each time they are elicited. Piaget does not, however, consider the role of hunger. Nor does he pursue the development of feeding behaviour beyond four months.

(b) Development in the Ability to Recognise Hunger and Appetite.

Perhaps the main theoretical contributions to an understanding of development in feeding behaviour concern the development of motivation as presented by Mursell (1925); Hamburger (1960) and Bruch (1974).

Mursell (1925) starts with the assumption that hunger and appetite should not be considered as two independently motivated aspects of food consumption. Rather, the drive for food is a complex unit of behaviour that develops from an integration of a variety of learning experiences. Whilst, indeed, feeding behaviour has its origin in the learned connections between sucking and gastric hunger, it is also capable of functioning in the absence of gastric peristalsis. Learning is thus also said to occur through the tendency to suck, the general impulsions due to biochemical need (positive chemotropisms that set up cravings through learning) and the incidence of the nipple on the mouth. Thus the time, place and circumstances of the meal, rather than gastric peristalsis, may well become the important motivating factors for feeding to occur. Mursell came to this conclusion through an attempt to explain the diversity of taste preferences and dietary patterns, why it is that

individuals continue to eat once the gastric contractions stop, and yet how, despite these differences, the baby is able to regulate food intake. Mursell, like Ripin, uses the process of conditioning to explain the establishment of adult feeding patterns, and calls this 'trophic education'. The innate components are the sucking reflex, peristalsis and a chemotrophic mechanism in combination with peristalsis. Chemotropism is a mechanism whereby visceral responses occur to direct chemical properties of the food for which the baby has a strong biochemical need. These chemotropisms come to be linked behaviourally with taste, smell, texture and temperature of food that restores the baby's biochemical balance; the learning occurs when the food elicits the secretory responses. Appetite as an experience is thus a combination of the reflex visceral responses with the acquired pleasure of the taste and smell of food which may be present or imagined. The sucking reflex is said to start off as an undifferentiated activity. It then subsequently becomes integrated with hunger as a result of learning, (a) through positive chemotropism, and (b) through experiences provided by parents in their choice of the infant's food and in the regulation of meal times.

Mursell does not seriously consider regulation of intake, nor, apart from sucking, is the infant's behaviour specified other than by implication,not surprisingly, since no empirical support was used at all.

Hamburger (1960) takes as his starting point, the physiological theories of Cannon (1932) and Carlson (1916) and similarly, treats appetite and hunger separately, but in a somewhat different sense from Mursell (1925). For Hamburger, hunger refers to physiological regulations and processes at a cellular, hormonal or organ level.

Appetite becomes a mental construct incorporating memory, symbolic representation, perception and affect. This latter cerebral cortical system is said to act as an integrator between the various physological and psychological mechanisms involved in the regulation of food intake. Hamburger postulates that development essentially reflects a change from sub-cortical to cortical control. At birth the neonate is said to show no evidence of goal-directed, purposive appetite regulation; only instinctive hunger regulation operative at a sub-cortical level. The response of the newborn is an undifferentiated mass reaction so that whilst crying, motor restlessness, mouthing behaviours and autonomic changes may be interpreted as hunger, it cannot be assumed that the baby FEELS HUNGRY. Hunger is simply one of the many stimuli that produce an unpleasant state. Acquisition of appetite and appetitive behaviour requires (1) the ability to recognise food by sight, smell and taste; (ii) the ability to appreciate perceptually the feeding person; (iii) the presumed memory of past feeding; (iv) the presumed anticipation of relief from the discomfort of hunger. Hamburger postulates that this ability is not present until about the fourth or fifth month of life and occurs as a consequence of repeated cycles of hunger-eating-satiety over many months. The early instinctive hunger regulatory behaviour is not seen as being a part of this developmental process. It is simply the result of conditioning or imprinting that survives as associations of strong feelings (a) of displeasure with hunger (b) of pleasure with appetite and (c) of the self- and object directed attitudes and expectations which become associated with the mother through the mother-child relationship, with eating and with oral gratification.

In line with Mursell, how food intake is regulated is never

made explicit. Nor does Hamburger describe the activities of feeding; again there is little reference to any studies of infants and young children apart from a reference to studies showing the capacity for taste in the human infant at birth.

The development of motivation thus far is conceptualised either as a complex system incorporating hunger and appetite, or as two independent systems with different mechanisms; appetite as a cognitive system, and hunger as a sub-cortical system. Bruch (1974) offers a third possibility, and like Hamburger, distinguishes between the physiological state of nutritional depletion and the psychological processes involved in perceptual and conceptual awareness of the nutritional state. But unlike Hamburger, Bruch treats hunger and appetite as being on a continuum. Development within this theoretical construct is, therefore, the acquisition of the ability to perceive hunger and its associated necessary concept or "engram". Achievement of this ability rests on correct learning experiences and interaction with the environment. "Correct" learning experiences are provided by the mother and are offers of food in response to signals indicating hunger; (the only signal that Bruch actually specifies is the CRY). The necessary assumption for this theory is that right from birth there are clear signals that indicate biological needs, although no evidence is provided to support this view. Rather, support for the role of the mother is drawn from a study by Ainsworth and Bell (1969) on the nature of mother-infant interactions in the feeding situation during the first three months of life. Successful development, specified as normal weight, and ability to sustain separation from mother at 12 months, was found to be related to the sensitivity with which the mother responded to the baby's

signals during feeding. Allowing the baby to regulate its own feeding schedule, to be an active participant during the feed, and to be appropriately responded to following various signals were used as measures of sensitivity. Twenty-six mother-infant pairs were studied and six became overweight because it was said that their mothers overfed them. Overfeeding was said to occur for two reasons:-

(i) through attempts to gratify the child, thus treating too broad a spectrum of cries as signals indicating hunger;

(ii) to make the children sleep for a long time.

No consideration was given to the fact that the baby might be giving inappropriate signals. Nor was there any mention as to what 'overweight' and'overfeeding' meant in terms of actual weights and amounts of food consumed, and no consideration of the mother's parity which is known to affect intake (Thoman et al., 1972). Nevertheless, Bruch (1974) interprets the results as indicating that overweight in these cases results from faulty learning experiences provided by the mother. Whilst Bruch may be right, it is questionable as to whether the evidence she uses actually supports her position.

An alternative explanation to Bruch's comes from the results of a study by a group of workers who are also interested in the consequences of mother-infant interaction during feeding, but who focus on more specific aspects of behaviour (Sander, 1962; Sander and Julia, 1966; and Burns et al., 1970). They recorded whether feeding was on a fixed nursery schedule or by demand, and then observed to what degree an infant became distressed during a feed

when the caretaker was changed. Distress was measured by the amount of grimacing, turning away from the nipple, spitting up, fussing and crying. This ability to show distress was considered as providing evidence of the ability of an infant to respond to change in the caretaking environment and it was suggested that this ability points to an establishment of expectations for key features in the environment. It was found that infants who were fed on demand in the first ten days of life and thus receiving individualized and special care, were capable of responding in this way. Burns et al. (1972) postulate that an important component of regulation in feeding may, therefore, be this capacity of the infant to signal that something is wrong. For the development of successful feeding what may thus matter is that the infant is allowed to use this signalling system, otherwise it will be "turned off" or will drop out, and so lead to a failure to thrive. Not responding to infants rather than, as Bruch proposed, reinforcing incorrect behaviour is what really matters. Brody (1956) has also shown that satisfactory weight-gain was correlated with mothers who were "sensitive, consistent and attentive ..... conspicuous for their ability to accommodate to the needs of their infants". This also suggests that in feeding, what is important is to allow the infants to respond appropriately.

One is, therefore, left wondering which of the three theories provides the most useful approach to the understanding of development of appetite. None of the theories concern themselves with the full repertoire of feeding behaviour and there is no attempt to explain how change in the motivational system interacts with development in the perceptual and cognitive processes, to enable

the establishment of successful feeding. As Dunn (1975) warns, early interaction patterns may not in fact reflect a continuity with later development.

1.5 THE NEED FOR AN OBSERVATIONAL STUDY OF THE DEVELOPMENT OF INFANT FEEDING.

At birth human infants appear to have a complex feeding repertoire. Prior to a feed the newborn engage in oral activities followed by fussing and then crying; of the oral activities,only mouthing has been systematically shown to be related to hunger, and although crying is always assumed to be 'hunger-related' there has been no systematic study to substantiate the cliam. The integrated feeding mechanism combining sucking, swallowing and breathing is established shortly after birth but the actual means of obtaining food differ according to whether the supply is from the breast or from a bottle. Taste, physical properties of the object sucked, satiation and fatigue, are all responded to by changes in the sucking pattern, thus suggesting that not only is there a sophisticated feeding repertoire present at birth, but, that the immature organism also appears to have the ability to respond differentially to changes that arise from both internal and external sources. But the nature of this capacity and how it is organized in the natural context of feeding is little understood. One reason for this is that there has been little consideration of the functional significance of the various components of the feeding repertoire. Rarely has a comparison been made between breast and bottle feeding. Also, as so often appears to happen in psychological study, different approaches to the study of behaviour produce followers who appear to be reluctant to consider contributions from other points of view. Many of the studies that have been reviewed are couched within the behaviourist tradition so that

learning theory is the predominant paradigm within which the studies are set. Cognitive-developmental issues are thus rarely considered. However, the problem does not lie entirely at the door of the behaviourists; the cognitive-developmentalists have only an indirect interest in feeding behaviour. (Piaget, 1936).

Even more surprising is the dearth of studies on the development of feeding behaviour. Theory concerning motivational issues abounds, but is supported principally by casual observation rather than by systematic analysis. Here, in contrast to the studies of the newborn, contributions are made,not only by the behaviourists,but also by theorists within the psychoanalytic school. The general interest concerns the development of appetite and the ability to use the experience of hunger to regulate feeding. The current speculation is that the mother-infant relationship is the key to the success with which the infant acquires the "correct" engram of hunger. The detailed behavioural analysis needed to support or reject this hypothesis, however, is not yet available. Observations of feeding behaviour beyond the second week of life principally concern the different methods of feeding used by the infant. Sucking, spoon-feeding and drinking from a cup are identified as the principle milestones of development and are described once they have been acquired. There is no consideration given to the process of their acquisition, nor how parallel developments in the general perceptual or cognitive processes contribute to this development. Ripin's study stands out alone as being one of the few serious attempts to investigate feeding as a behaviour in its own right. Thus, the weakness of the 'developmental literature' is most obvious when any attempt is made to appraise which behaviours identified in the feeding repertoire of the neonate remain throughout infancy, which behaviours are modified,

Which behaviours drop out, and, importantly, when new behaviours appear and at what stage in the process of development. Without this picture any attempt to understand the nature of the processes involved in development is severely limited, not least because the choice of behaviours used to analyse the mechanisms involved will necessarily be arbitrary. As Blurton-Jones (1972) has argued, unless observation precedes experiment, the hypotheses tested may well be unrealistic and the consequent tested effects may have little to do with real life phenomenon. It is, therefore, because of the absence of this important descriptive phase, (which Hinde (1974) considers to be essential in the development of every science) that an observational study of the development of infant feeding was chosen for the present investigation.

As a contribution to the descriptive phase, this thesis has, as its aim, a description of the infant's ability to express satiety from birth to six months of age including the role played by the mother and the nature of mother-infant interaction.

The hypotheses to be tested are:

1. that the potential for the expression of satiety is present at birth,
2. that the method of expression of satiety changes with age,
3. that the feeding technique makes a difference in the expression of satiety,
4. that the caretaker-infant interaction plays a part in the infant's expression of satiety.

CHAPTER TWO

RESEARCH PROBLEM

2.1 INTRODUCTION.

Having decided to undertake an observational study of the development of infant feeding from birth to six months, the next problem is to work out a framework from within which the observations can be appraised. For this framework, theoretical considerations of food intake and of the study of development are examined. This is not an exercise to establish WHAT behaviours to observe, but rather a method by which the contextual aspects of the study can be identified so that the results can then be analysed within a developed theoretical framework.

2.2 STUDIES ON FOOD INTAKE.

Contributions to the study of food intake come from such varied fields as genetics, ethology, physiology, physiological psychology, social psychology, epidemiology, paediatrics, clinical medicine and psychiatry. (Schachter, 1971; Reichsman, 1972; MacKeith and Wood, 1971). A central concept to emerge out of these many and varied approaches is that of regulation. Since it is a concept that has been used to provide understanding at different levels of analyses, it is thus the one chosen to provide pointers for the relevant parameters.

One way in which the characteristics of food intake have been described is in terms of the temporal patterning. (Marler and Hamilton, 1966). It has been shown that the amount of food consumed can vary according to the time of day (diurnal feeding rhythm), the number of meals in the day; the size of the meal and the interval between the meals (Le Magnen, 1972). Whilst much of

the work has been with rats and dogs using experimental techniques that are difficult to apply to human studies, there are reported studies on the regulation of food intake in the human infant (Gesell and Ilg, 1937; MacKeith and Wood, 1977). Although the data collection is not as rigorous as that collected in the studies reported by Le Magnen, (1972) and only seriously concerns breast-fed infants, nevertheless, similar characteristics emerge, namely, variations in meal size, meal frequency and meal interval.

The next level of analysis considers answers to the question of why does the organism start eating and why does it stop?. It is apparent that, in part, answers point to the need to distinguish between both external and internal determinants. (Marler and Hamilton, 1966; Schachter; 1971 and Nisbett, 1972). In general terms, external factors include palatability, visual characteristics, olfaction (Marler and Hamilton, 1966; Nisbett, 1972) and in man, social and cognitive cues. (Nisbett, 1972). When considering an organism that is dependent upon another for its food supply, a further factor that acts as a direct and indirect control on the dependent infant's intake is the source and giver of the food, namely the mother (or caretaker). Aspects that have been shown to affect intake directly or indirectly include the emotional state and parity of the mother (Thoman, et al., 1970; 1972); drugs given to the mother during labour such that they alter the performance of the infant's sucking during the feed (Richards and Bernal, 1972); and the availability of milk from the mammary gland (Kennedy, 1966; MacKeith and Wood, 1971). Behavioural aspects are yet to be explored and form part of the study of this thesis.

Internal factors, on the other hand, include full or empty stomach and, more problematically, changes in the blood sugar

level. (Le Magnen, 1972; Dwyer and Mayer, 1973). The dependent organism is also a growing organism and growth itself makes its own demand on energy supplies and thus affects levels of intake. (MacKeith and Wood, 1971). Whilst this is not directly an internal factor, it does indirectly alter the internal regulatory controls and, therefore, needs to be taken into consideration.

Further analysis in the quest to understand the factors involved in stopping and starting a meal, concentrates upon attempts to unravel the nature of the mechanisms. Regulation in this context is considered in terms of the factors underlying the processes of hunger and satiety. Psychological and neurophysiological approaches have contributed to the knowledge in this area. Included are studies using the psychological concept of motivation combined with the examination of the role of the hypothalamus (Balagura, 1972) and the extra hypothalamic areas of the brain (Grossman, 1972) in the regulation of eating behaviour. Despite the arguments about the exact nature of the neural substrate, there is, nevertheless, agreement that hunger and satiety are separate mechanisms. However, they do not operate independently. Certainly, from extensive work on dogs and birds, it looks as though closely associated with feeding systems, are the systems involved in emotional behaviour and general arousal, (Wright, 1975).

Regulation as a concept has also been used to understand the properties of food intake through a study of the organism's ability to manifest adaptive changes as a result of experience, namely, changes that are a result of learning. (Thorpe, 1956). Ewer (1968) reviewing the ethological studies of food eating habits of mammals, reports that learning appears to be responsible, at least in some

species, for the choice of food eaten. Its role in the more general changes that occur during the course of development is, however, less clear mainly because there are few reported studies. From those available, some reports suggest that the way in which food is manipulated by the animal is learned, whilst casual observations presented by Ewer revealed that the feeding patterns used by a hand-reared guinea-pig were present before the eyes were open and, therefore, tend to support the alternative view that they are a genetically controlled phenomenon. In terms of other aspects of what are said to be learned and loosely called feeding habits, Booth et al (1976) have shown that in both animals and man satiety is in part learned by connecting the flavour of the food with its consequent satiating effects. This potential for an acquired sensory cue to act as a control on intake may be an important factor in facilitating solid food intake in early life and thus be a contributory factor in establishing adult feeding habits.

2.3 DEVELOPMENTAL STUDIES.

The study of development is also a concern not only of psychologists but of many workers in other disciplines. Generally it can be said that there are two ways of looking at behavioural development. One is to look at the evolutionary development of behaviour using the comparative method, whilst the other is to study developmental change within the individual throughout his life span. Traditionally the former is referred to as the phylogenetic study of behaviour whilst the latter represents the ontogenetic study. Both, however, are concerned to understand the processes underlying the changes in the behaviour and the ability of the organism (or species) under study. Of central interest, therefore,

are the principle issues from which the search for answers arise.

(a) Conceptual Issues.

Arguments that have dogged the study of development in the past concerned such dichotomies of explanation as learned versus innate, or intelligence versus instinct. As Hinde (1974) has repeatedly shown the debates are sterile since it is now clear that, for example, it is naive to assume that processes are either a result of maturation or learning according to whether they are subject to external influences or not. What really is of interest is the way in which the organism and the environment interact, since it is this interplay which is the very essence of development. Bower (1974) reaches the same conclusion, elegantly illustrating the fallacy of any extreme nativist or empirist position. Emerging from both these new perspectives are questions that direct attention to new issues such as the nature of the built in constraints, and how learning and development are related. The thrust of this new approach emerges from the finding that learning also has its limits; the organism has to be prepared before it can associate events, (Seligman, 1970) and this preparedness may well be reflected in the level of the cognitive structures. (Piaget, 1950). Differences of opinion now centre on the level of conceptualisation needed. Does development occur at the level of behaviour itself or at a level more abstract than behaviour? As yet there is insufficient evidence unequivocally to allow a choice to be made The crux of the matter is whether it is more parsimonious to assume separate independent changes in each behaviour or to assume change at a more abstract level thus using some concept such as 'structure' or 'schema' to describe the source from which different behaviours are generated.

Whatever the outcome, it would seem that if one is to capture the subject matter of development, the behaviours studied should be as diverse as possible. One cannot begin to argue about the generative capacity of the infant if it is not known whether in fact different behaviours serve the same ends or the same behaviours serve different ends. Bryant's (1973) challenge that development is not about the development of new capacities but about the change in ability to put the capacity into use is an effective alternative view to put to the test. Feeding habits are widely acknowledged to originate in childhood. But what these habits are and whether the same behaviours at different ages reflect similar underlying structure and organisation, remains an open question. Critical appraisal within the context of these developmental issues may help towards providing questions from which answers can be sought.

(b) Role of Social Relationships.

It is becoming increasingly clear that an important factor contributing to the child's development is the nature of its interaction with its mother, or mother substitute. A contemporary worker who has dominated the scene, is Bowlby (1969) with his emphasis on the presence of the mother for normal emotional development. This led to the concept of attachment, and with it the emphasis of the mother's effect on the child. From within this perspective the child is not seen as an active participant but is seen only as the passive recipient of care. Feeding behaviour would thus be solely determined by the mother and the acquisition of feeding habits a result of the experiences she provides. Much of the current paediatric literature on faulty infant feeding practices reflects just this view. (Taitz, 1971; Oates, 1973). So also does the

view of Bruch (1974) when she postulates that hunger awareness is learned through the mother's correct response to the child's expression of bodily needs. Indeed the large body of research which presented efforts to relate child-rearing practices, including the practice of infant feeding, to particular attributes of personality, used this model. Caldwell (1964) in her review of the literature, shows the lack of success of this approach. Also, recent workers have shown a growing dissatisfaction with the basic assumption. (Bell, 1968; Barnett, 1973). Both from animal studies and human studies it is becoming clear that whilst mothers do indeed affect the behaviour of their offspring, so does the infant's behaviour affect the mother, (Ressler, 1962; Escalona, 1969). Thus, to understand the feeding processes and their subsequent developmental changes, it would seem important to include a study of the process of interaction since by definition, infant feeding includes the mother's participation. Indirect evidence for the infant's influence on the mother's behaviour during feeding is discussed by Richards (1971) and postulated by Wolff (1955). This project will look for more direct evidence of the interplay between the two actors.

2.4 OBSERVATION AND THE ETHOLOGICAL APPROACH.

Now that the contextual aspects of the study have been briefly outlined, one moves to the central research problem, namely the appropriate method to adopt in designing an observational study.

This is where ethology makes its contribution, since it has been concerned with describing behaviour through observation in natural settings. As an approach it differs from that used by developmental psychologists or the more traditional experimental psychologists both in the methods used and in the questions asked.

The major premise is that the study of behaviour must begin with an ethogram, (Hess 1970). What this means is that before attempting to systematically modify behaviour, the ethologist wants to know what behaviour there is to modify. This is in contrast to the latter approaches where studies pursue the testing of hypotheses which are derived from a theoretical perspective or armchair speculation. Thus, the behaviours chosen for study may or may not be representative of behaviour that reflects real life phenomenon. As one of the reasons for pursuing the study of infant feeding behaviour is to provide knowledge for child care practices then it is axiomatic that real life phenomenon are examined. There is, therefore, a good practical reason for choosing an ethological approach.

It is not, however, only this insistence on an ethogram before pursuing experimental analyses on behaviour that establishes the hallmark of the ethological approach. Questions are asked within a wider perspective incorporating a biological as well as a psychological approach to behaviour. (Bateson, 1968). Interest focuses on the why and how of behaviour, not perhaps on the surface appearing to be very different from developmental and experimental psychology. But, in fact answers are sought about the immediate causes of behaviour, about development and learning, about the survival value of behaviour and about its evolutionary origin. (Tinbergen, 1951). So that, as Smith (1974) points out, whilst questions dealing with causes, development and learning are also the concern of psychologists interest in the biologically orientated question of function and survival value, until very recently, have not been. The contribution of this wider perspective to the study of child development is currently being explored. (McGrew, 1970; Hutt and Hutt, 1970; Blurton-Jones, 1972; Connolly, 1973; and Smith, 1974). The main

focus of study so far has been on the development of social behaviour through such concepts as attachment, exploration, play and aggression. But it has, nevertheless, been shown that behaviour during feeding can be the subject of such an approach (Ainsworth and Bell, 1969; Richards and Bernal, 1972; Blurton-Jones, 1972). For example, Blurton-Jones (1972) used the evolutionary perspective to propose that the human infant is adapted for continuous feeding. He based his argument on a comparative analysis of milk composition and feeding schedules in different mammalian species.

In order to develop their observational approach, ethologists have developed methods specifically designed for each particular aspect including methods to study interactions between individuals, and the nature of age-dependent changes. It is these latter techniques which have been adapted for use in this study. The flavour of these techniques is best illustrated in the two following examples. To analyse the nature of social interaction the aim is to distinguish between what initiates an interaction from the effects that one individual's behaviour has upon another. This particular technique has been developed by several workers. (Hinde and Spencer-Booth, 1968; Richards and Bernal, 1972). Essentially it involves detailed observations of sequences of interactions in which the direction and the effect of behaviour is scored. The study of development, on the other hand, is concerned with the basic questions of what changes occur in the organisation of behaviour as the individual grows. What is emphasized is the need to recognise the possibility that development of any one behaviour may, in fact, be a consequence of many underlying mechanisms. As it is clear from the work of the psychologist Lewis (1967), when studying development, it is

important that one also considers the meaning of the response. For what Lewis found in his own work was that crying in infants of one month reflects an active, positive response, whilst at one year, it is a passive response. This alerts one to the fact that the meaning of a response can change at different ages.

The question of WHAT behaviour to observe has also demanded a separate approach. Hinde (1966) has drawn a distinction between the description of the physical aspects of the behaviour, and a description of behaviour by its consequences. The level of the descriptive categories or units to be used need to be large enough to allow the study to be practical and yet fine enough to allow for distinctions to be made. (Marler and Hamilton, 1966).

The description of the physical aspects of the behaviour is usually captured through a definition of the patterns of movement (or sound) in spatio-temporal sequences. Anything finer than this is considered to be not only impracticable but unnecessarily detailed and clumsy. But the number of movements (or sounds) to be included and the level of description used, depends upon the nature of the study. For example, infant sucking behaviour may be described in terms of: -

(i) a continuous stream of sucking;

(ii) a burst-pause pattern;

(iii) the number of sucks per burst and intersuck intervals;

(v) the mechanism of each suck (negative pressure or stripping action) in relation to the number of sucks and intersuck intervals.

Whilst the fourth level of analysis provides the most objective record, it may, at the same time, require a more sophisticated recording technique. What this can then do is limit what other

aspects of behaviour can be observed, and so reduce the possibility of a more thorough analysis of the behavioural repertoire. The introduction of intrusive technical equipment will not necessarily resolve the problem as it may produce an artificial environment and thus destroy the very essence of the naturalistic study. Sucking at the breast is an example of just this problem. Any apparatus developed to record the infant's sucking behaviour has to be attached to the infant or to the mother's breast in some way, and in so doing interferes with the very process that is being recorded. It is for this reason that it was decided that sucking behaviour would only be scored by an observer. It also ensures that a fair comparison can be made between breast and bottle feeding. But it has meant that the definition of sucking only covers the organisation of sucks and not the characteristics of the mechanism used.

Behaviours to be defined by their consequence and the physical characterists of the more general developmental aspects of feeding were not defined at this stage. All that was recognised was that the terms used must be neutral and objective and that it is important to appreciate that there may be variations in the components of the behaviour expressed according to the intensity of the response. Again, using sucking as an example, infant sucking patterns may vary at different stages in the feed and according to whether the infant was woken for a feed or was awake and crying.

Classifying the behaviour into categories also poses a problem. What is usually taken into account is whether there are behaviours having the same form; serving the same kind of consequence or effect upon the environment; occurring in the same situation; sharing common causal factors; or sharing a common origin.

(Hinde, 1966; Marler and Hamilton, 1966; Bateson, 1968; Hutt and Hutt, 1970; Brannigan and Humphries, 1972). Richards and Bernal (1972) used three types of categories in their study, There was a descriptive category (e.g., mother talks to infant), a category that indicated the position of the individual (e.g., position of infant relative to mother) and a category that described the behaviour by outcome (e.g., mother stimulates infant to suck). The choice of categories ultimately depends upon whether they are useful in analysis but they must also be reliable and valid. Again decisions about exactly which categories to use were left open until after the preliminary phase of the study and are presented in Chapter 4.

2.5 RESEARCH STRATEGY

Thus direct observation of the naturally occurring feeding behaviours in both infant and mother will be carried out incorporating methods developed by ethologists in contrast to the use of interview techniques or rating scales derived solely from armchair speculation or theory. The observations will then be used to describe the categories of feeding behaviour which occur between birth and six months of age in the human infant, and in the mother. (Chapter 4). The subsequent analysis of behaviours used to express satiety, and the mother's behaviour in relation to her infant will then be presented so that they can be discussed either within a developmental perspective or looked at in relation to the relevant results drawn from studies on food intake. (Chapters, 5,6, and 7). This study will thus draw upon ethology for its methodology but aims to take a rather wider theoretical perspective for the final analysis.

The one remaining problem to be discussed is what constitutes a

natural environment. This is difficult to define unambiguously because it depends upon what is meant. For some it may mean an environment unspoilt by the trappings of contemporary Western Society. Natural then tends to become synonymous with primitive. Whilst for others it may mean a consideration of both biological and social factors, a stand that is taken to contrast the view that simply considers the social facts. Practical considerations, apart from philosophical criticisms, rule out the former approach. Whilst on theoretical grounds there are strong arguments in favour of the latter approach. Human eating patterns are governed by both biological and social factors in contemporary Western Society. So if one is going to study ontogeny of feeding behaviour, then contemporary social factors become an important component of the external environment. In fact they may even determine part of the biological environment for the infant through social controls. For example, Blurton-Jones (1972) speculates that vomiting and 'possetting' in human babies may be a result of schedule feeding. But the reason why mothers choose to schedule feed may reflect social pressures that are a consequence of urban life. As Le Magnen (1972) points out the traditional meal pattern of Western man is one where there are a number of meals at fixed intervals. Schedule feeding is thus the normal form in which adults eat and children when they become fully socialized into the family organisation.

Exclusive concentration on social factors, however, must also be avoided. Blurton-Jones, in the same study, argues that the infant is adapted not for schedule feeding but rather for continuous feeding. He came to this decision following his comparative study where he found a relationship between the composition of milk, the frequency with which the young feed and their subsequent growth rate. A

study which only considers behaviour in terms of social facts would thus ignore the biological-social interaction effects implied in the process of adaptation from continuous feeding to feeding at fixed intervals. The family setting and the feeding patterns of that family form the natural setting in which this change occurs. Thus, the major part of this study will be carried out in the home whereby both the biological and social factors will hopefully be captured.

The complicating factors are the degree to which medical constraints imposed on childbirth can be said to fall within the term 'Natural'. Unfortunately, in Scotland, all births now take place in hospital. So that whether it is natural or not, practical considerations demand that the hospital be the normal setting for the period immediately following birth. Hence, not only will the start of the study of the development of feeding behaviour occur within a medically orientated environment, but it will be forced to fit in with the medical and nursing constraints that influence the very early feeding behaviours., (e.g., 8 a.m. round of taking the infant's temperature, thus disturbing the sleep patterns). The way in which some control will be made is to restrict the study to one hospital. All mothers and infants will, therefore, be subject to the same general hospital policy with slight differences in management then occurring only at ward level.

CHAPTER THREE

METHODS.

3.1 SAMPLE

Twenty mother-infant pairs form the sample upon which the main study is based (see Table 3.1 for details). Mothers approached were only married mothers who had just delivered their first or second child and, to reduce the burden of unnecessary travel, selection also rested on whether they lived within easy reach of Edinburgh and were on the telephone. All were caucasian, native English-speaking and most were of Scottish National background. They were each visited for a continuous period of six months, the main study taking 18 months to complete, starting in March, 1976 and finishing in August, 1977.

The criteria used for the selection of the sample, apart from the social aspects already stated, were that mother had an uneventful pregnancy, labour and delivery and that the infant had no obvious abnormality. Uneventful pregnancy excluded the presence of any degree of pre-eclampsia and ante-partum haemorrhage or any record of other conditions known to present a potential hazard for the foetus. (Butler and Bonham, 1963). An uneventful labour excluded any mother who had a prolonged first or second stage of labour, and an uneventful delivery excluded mothers who had either a difficult forceps delivery or a caesarian section. Also considered were the drugs given to the mother during labour. Because of the recognisable effects of the drugs on the infant (Kron, Stein and Goddard, 1966; Richards and Bernal, 1972) every attempt was made to ensure that only mothers given the standard analgesia were included in the sample.

A normal infant meant an infant who weighed more than 2.500 Kgms. at birth (i.e., did not fall into the category of a low birth

TABLE 3.1

Background data of 20 mother-infant pairs in Study

Mother - Infant Pair.	Birth order	Sex of Infant	Birth Weight of Infant	Apgar Score		Type of Delivery	Type of Feeding
			Kgms.	1mn.	5ms.		
MK	2	M	2.807	8	9	Normal	Breast
CU	2	M	3.629	9	10	Low forceps.	Breast
MU	2	F	3.742	8	9	Normal	Breast
HA	1	F	3.912	8	10	Normal	Breast
RO	2	M	3.884	9	10	Normal	Breast (Bottle at 6 months)
TH	1	F	3.600	8	9	Normal	Breast
GR	2	M	3.459	8	10	Normal	Breast (Bottle at 5 months)
RA	1	M	3.090	8	10	Normal	Breast
LE	1	M	3.941	9	10	Low forceps	Breast
HB	2	F	3.317	8	9	Normal	Breast → Bottle at 3 months.
NE	1	F	3.090	9	10	Normal	Breast → Bottle at 2 months.
BR	2	M	2.948	8	10	Normal	Bottle
MI	1	M	3.544	9	10	Low forceps	Bottle
BU	2	F	3.317	9	10	Normal	Bottle
MN	2	F	3.714	9	9	Normal	Bottle
BL	2	F	2.693	8	10	Normal	Bottle
SC	2	F	3.360	8	9	Normal	Bottle
MA	1	F	3.459	10	10	Normal	Bottle
AT	1	M	2.948	8	9	Low forceps	Bottle
FA	2	F	3.459	9	10	Normal	Bottle

weight infant or small for dates infant), was not born prematurely and had an Apgar score of 8 and above at one minute and between 9 - 10 at five minutes. Apgar scoring is a means of standardising the method of evaluating and recording the condition of the infant at birth. (Apgar 1953). The measures making up the score are shown in Table 3.2.

TABLE 3.2

Measures Making up Scoring System of Apgar Test

	SCORE 0	SCORE 1	SCORE 2
Colour	Blue - pale	Body pink - limbs blue	Completely pink
Respiratory effort	Absent	Slow, irregular weak cry.	Strong cry
Heart rate	Absent	Slow, less than 100	Over 100
Muscle tone	Limp	Some flexion of limbs	Active movement
Response to flicking foot	Absent	Facial grimace	Crying

(based on the work of Apgar (1953)

The ultimate score is a sum of individual scores given for the five states measured, and has a moderate predictive value of the infant's future neurological status.

Although it is known that sex of the infant (Moss, 1967; Thoman, et al, 1972) and birth order (e.g., Thoman, et al, 1971, 1972) affect both infant and the nature of mother-infant interactions during feeding, time, and thus the limited number of mother-infant pairs which could be studied, made it impossible to produce a counter-balanced design. To enable a comparison to be made between the

feeding techniques, the aim was, therefore, to include an equal number of breast and bottle feeders, and balance, as far as was possible, for birth order and sex of the infant. However, because some mothers changed from breast to bottle feeding during the course of the study, even this aim was not stricty met. The division according to technique which thus emerged was: -

7 mothers breast feeding throughout the study;

9 mothers bottle feeding throughout the study;

4 mothers who changed from breast to bottle feeding, 2 before the fourth month and 2 at the end of the period under study.

The two mothers who changed their technique before the fourth month were then included in the bottle feeding group because on inspection of their records no obvious differences with the records of the other bottle feeding mothers could be detected. The two mothers who changed at the end of the period were not, however, included.

The distribution of birth order and sex of the infant, despite the limitations of the sample, was fairly even. Altogether, there were in the original breast feeding sample: -

5 males	4 females
4 first borns	5 second borns

and in the original bottle feeding sample: -

4 males	5 females
3 first borns	5 second borns

In the two mothers who changed to bottle feeding before the fourth month, both infants were females, and one first born and one second born. Overall the sample structure was thus: -

9 males	11 females
8 first borns	12 second borns

Because of the small numbers, there was also no attempt to ensure that the sample adequately reflected the social class stratification within the population of Edinburgh. However, it also remains an open question as to whether this is a useful procedure to adopt in a study concerned with description and analysis of a behavioural repertoire. It could lead to the setting up of arbitrary typologies that turn ones attention away from other forms of analysis (Richards, 1971; Richards and Bernal, 1972). For example, currently the climate of opinion within clinical circles is that bottle feeding is predominantly practised by working class mothers; substantiation for this claim coming from such work as Newson and Newson (1963). It is also known that working class mothers are more likely to have complications arising during pregnancy and labour. There is, therefore, a danger of associating differences which might arise as a consequence of bottle feeding, either to obstetric complications or to features inherent in the belief system of working class mothers. Certain characteristics associated specifically with the technique may thus be obscured through an assumption that they are a consequence of medical or cultural factors rather than the technique per se.

3.2 ESTABLISHMENT AND DESIGN OF THE STUDY.

Mother-infant pairs were visited seven times during the six month period under study. They were initially seen during the first week following delivery, at WEEK 4 and then at four weekly intervals until WEEK 24. One hospital only was used for recruitment, a large maternity hospital in Edinburgh. The sample was drawn from all three post-natal wards. All staff concerned were approached before the study and gave their permission for the

research team to have free access to the patients. The Ethical Committee of the hospital also gave formal permission for the study to be undertaken.

As the results analysed and discussed in this thesis are drawn from the results of a larger study, the design of the larger study into behavioural precursors of obesity will be outlined. The mother is first approached on the second day after delivery. Before recruiting her into the study there is a thorough discussion of the procedures involved, the number of visits that will be made and the methods of observation to be used. Emphasis is placed upon the infant rather than the mother in keeping with the practice of other observational studies of mother-infant interaction. (Moss, 1965; Richards and Bernal, 1972). Twenty-four hours later, after the mother has had time to discuss the project with her husband, she is interviewed. The aim of the interview is two-fold; to collect information upon the age, sex, occupation, education and eating patterns of members of the nuclear family and to ascertain mother's knowledge and beliefs about certain aspects of infant feeding before her relationship with the infant has become firmly established. In the course of the pilot study it appeared that one of the factors that may affect the early patterning of infant feeding is the mother's preconceptions and thus expectations of what the infant 'ought' to do (Bernal (1972) and Richards (1974) also found that mothers vary in the way they interpret 'crying' and whether it is time for a feed). Twelve open-ended questions were put to the mother covering the choice of feeding technique, aspects of the feed which she considered to be important for her and the infant, reasons why infants cry, how she will decide about how much food to give at

a feed, how often she will feed the infant, how she will wean the infant and whether infants have taste preferences. Questions were chosen to elicit mother's views on whether infants can signal hunger or satiety, what patterning of meals she expects, whether infants can taste food and the degree to which she thinks that she ought to be in control of the infant's feed. Besides the interview the collection of data covers a video-record of the feed at the seven age periods, together with a paper and pencil record of the mother-infant interaction, an half-hour period record of the infant's immediate pre and post feed behaviour at WEEK 1 and WEEK 4, a consecutive three day record of the infant's intake and behaviour surrounding the feed to be recorded at each of the seven age periods, administration of the Brazelton Neonatal Behavioural Assessment Scale (Brazelton, 1973) and a non-nutritive suck test (Waldrop and Bell, 1966 modified by Richards and Bernal, 1972) when the infant is three days old, and a record of an anthropometric assessment of the infant at each of the seven age periods. (See Table 3.3).

Owing to illness, inclement weather conditions, holidays and no milk offered at the feed observed, seven filmed records of the milk feed were not available for all mother-infant pairs. Table 3.4 presents a record of those milk feeds filmed and those not filmed of the 20 mother-infant pairs used. For this thesis the data used is based on the video-record of the feed and the record of the milk intake for the feed observed. The paper and pencil record of the mother-infant interaction is used to supplement the material obtained from the filmed record where relevant.

TABLE 3.3

Data Collection of Larger Study from which results for this thesis are drawn.

AGE OF INFANT	DATA COLLECTED
WEEK 1 (in Hospital)	Day 2 Mother approached Day 3 Mother interviewed Neonatal Behavioural Assessment Scale Sucking Score Anthropometric Assessment of Infant Days 3,4, 5,6. Consecutive record of Infant's Intake Consecutive record of Infant's Behaviour Day 4 or 5 Half-hour record of Infant's immediate pre and post feed Behaviour Video-tape recording of feed Paper and pencil record of Mother-infant interaction
WEEK 4 (In Home)	Anthropometric Assessment of Infant Consecutive 3 day record of Infant's Intake Consecutive 3 day record of Infant's Behaviour Half-hour record of Infant's immediate pre and post feed behaviour Video-tape recording of feed Paper and pencil record of Mother-infant interaction
WEEK 8 to WEEK 24 (In Home)	Anthropometric Assessment of Infant Consecutive 3 day record of Infant's Intake Consecutive 3 day record of Infant's Behaviour Video-tape recording of feed Paper and pencil record of Mother-infant interaction

TABLE 3.4

Visits made to each Mother-Infant Pair throughout SIX Month Period

MOTHER-INFANT PAIR	WEEK 1	WEEK 4	WEEK 8	WEEK 12	WEEK 16	WEEK 20	WEEK 24
MK(breast)	✓	✓	✓	✓	✓	✓	✓
CU(breast)	✓	✓	✓	Holiday	✓	✓	X
MU(breast)	✓	✓	✓	✓	✓	✓	✓
HA(breast)	✓	✓	✓	Holiday	✓	✓	✓
RO(breast)	✓	✓	✓	Holiday	✓	✓	Now on bottle
TH(breast)	✓	✓	✓	✓	✓	✓	X
GR(breast)	✓	✓	✓	✓	✓	Now on bottle	Bottle
RA(breast)	✓	✓	✓	✓	✓	X	X
LE(breast)	✓	✓	✓	✓	✓	X	X
HB(breast)	✓	Breast ✓	✓	Holiday	✓	Bottle from Week 12 ✓	✓
NE(breast)	✓	Breast ✓	✓	Bottle from Week 8 ✓	✓	✓	✓
BR(bottle)	✓	✓	✓	✓	✓	✓	✓
MI(bottle)	✓	✓	✓	✓	✓	✓	✓
BU(bottle)	✓	✓	✓	✓	Mother ill	✓	✓
MN(bottle)	✓	✓	✓	✓	✓	✓	✓
BL(bottle)	✓	✓	Holiday	✓	✓	✓	✓
SC(bottle)	✓	Snowed up	✓	✓	✓	✓	✓
MA(bottle)	✓	✓	✓	✓	✓	✓	✓
AT(bottle)	✓	✓	✓	✓	✓	✓	✓
FA(bottle)	✓	✓	✓	✓	X	X	X

✓ Filmed record of feed

X No breast or bottle given at this feed

3.3 OBSERVATION PROCEDURES

(a) Type of Record.

The first stage of the study involved spending a period of four months observing mother and infant behaviour in the hospital. During this phase approximately 40 mother-infant pairs were watched covering both pre and post feed periods and the feed. The form of behaviours which had been used in the laboratory studies of feeding behaviour were used initially as pointers to what might be relevant behavioural categories. At first no record of the observations was kept but then, as classes of behaviour became apparent, these were slowly defined and used to compile a list of behavioural categories. Behaviours which appeared repeatedly within the context of feeding and behaviour that could be described objectively were those identified for study. At the same time discussions were held with mothers and midwives about feeding practice in general to get their different perspectives on what was going on, but the particular behaviours identified were not mentioned. It was felt that in the future, if Nursing Staff remained on the ward in which the study was being undertaken, they could inadvertently add bias to the data collected by influencing the caretaking activities of those mothers involved.

Once it was thought that the relevant behaviours had been identified, the next period of observation involved attempts to record the feed using these behaviours. Approximately 15 mother-infant pairs were used for this part of the study. Initially a paper and pencil method was used employing a pre-coded check list of behavioural categories. However, it soon became obvious that this method alone was not suitable because the various changes in sucking behaviour of the infant could not be listed in enough detail

to capture the possible changes occurring, particularly in terms of how they might act as potential signals. It was felt that to sacrifice these details might jeopardise the whole purpose of the study. Any thoughts of using frequency counts as a basis for analysis would then also have been out of the question, particularly following Altmann's (1974) criticism of the one-zero sampling methods. Thirdly, it destroyed the sequence in which behaviour occurred so further limiting the subsequent analysis that could be made. To overcome these problems, several other methods which could record all activities as they occurred were then tried. These included an event-recorder and a hand written commentary (e.g. Leach, 1972).

The event-recorder proved impractical for the initial recording because the number of behaviours to be scored exceeded the number of keys that it was possible for one observer to use. Equally, on occasions, behaviours occurred simultaneously, further complicating the coding system needed to preserve the various parameters required. This left the hand written commentary. However, this on its own also proved problematical because of the difficulty in recording details of the infant's sucking behaviour and the speed with which some mother-infant interactions occurred, thus reducing the reliability in the recording of such a large number of rapidly occurring behaviours. The solution, therefore, seemed to be to make a filmed record of the feed. An objection to this method is that it will so disturb mothers or distract the older infants that 'real' behaviour will not be seen. However, in general, this would not seem to be the case. Mothers were asked how they felt about the camera and most of them said that whilst they were aware of the camera they did not think that it had actually altered their behaviour, with the possible exception of

reducing the amount of talking they did to the infant. Older infants certainly looked at the camera during the feed but this seemed to be simply an extension of their general tendency to look around the room and pay attention to whatever interesting objects caught their eye.

The decision of how to record the feed having been made, the next step was to carry out a pilot study. Six mother-infant pairs were recruited and followed up for six months. It was then discovered that still not all the problems were removed because it became obvious that when the camera focussed on the sucking behaviour of the infant, the broader aspects of the feed, including mother's general behaviour, could not be recorded. If the camera was then positioned to include these more general aspects, the resolution was so poor that very little detail of any sort could be obtained. This led to the final decision that for the main study two methods of recording would be used. A video-tape record would be made of the infant's feeding behaviour, including as much of the mother's behaviour as could be fitted into the picture without losing the detail of the infant's sucking movements, and, simultaneously, a written commentary would be made on the more general aspects of the feed. One person thus filmed the feed and a second person recorded the paper and pencil commentary in the form of a running record of events as they occurred, with the time marked at the end of each minute. To ensure consistency within the study, each record was made by the same person throughout with the author doing all the filming.

(b) Film recording of the Feed.

Because most of the filming was to be carried out in the home, the equipment chosen had to be portable. For this reason, the

portable AD/DC operation Sony equipment was chosen. It includes the Sony Video Camera (AVC-342 OCE), Sony Videocorder (AV-342 OCE), and AC-power Adaptor (AC-342 OCE). The video-tapes supplied ran for approximately 30 minutes.

On the morning of the film day, mothers telephoned to give the approximate time of the next feed. Morning feeds were chosen because they were those most convenient for filming in the hospital and were the times best suited for most of the mothers once they were home. Some older siblings would then be at school, mothers tended to visit the well-baby clinics in the afternoon and visitors were less frequent. One particular time in the day was chosen in preference to any attempt to cover all possible times when feeding could occur, because, given the nature of the study, it would have been impracticable to meet the demands required. Besides the problems of fitting in filming sessions at these varied times, the small numbers precluded the possibility of achieving a reasonable number of feeds at each possible time which would be needed to overcome any imbalanace. This has obviously provided a bias in the study because any diurnal variations occurring will be missed. The other disadvantage of choosing this particular time was that as the infants got older, the feed filmed tends to be at mid-day. Several milk feeds were thus missed because mothers, when they dropped the number of milk feeds offered tended to drop this feed.

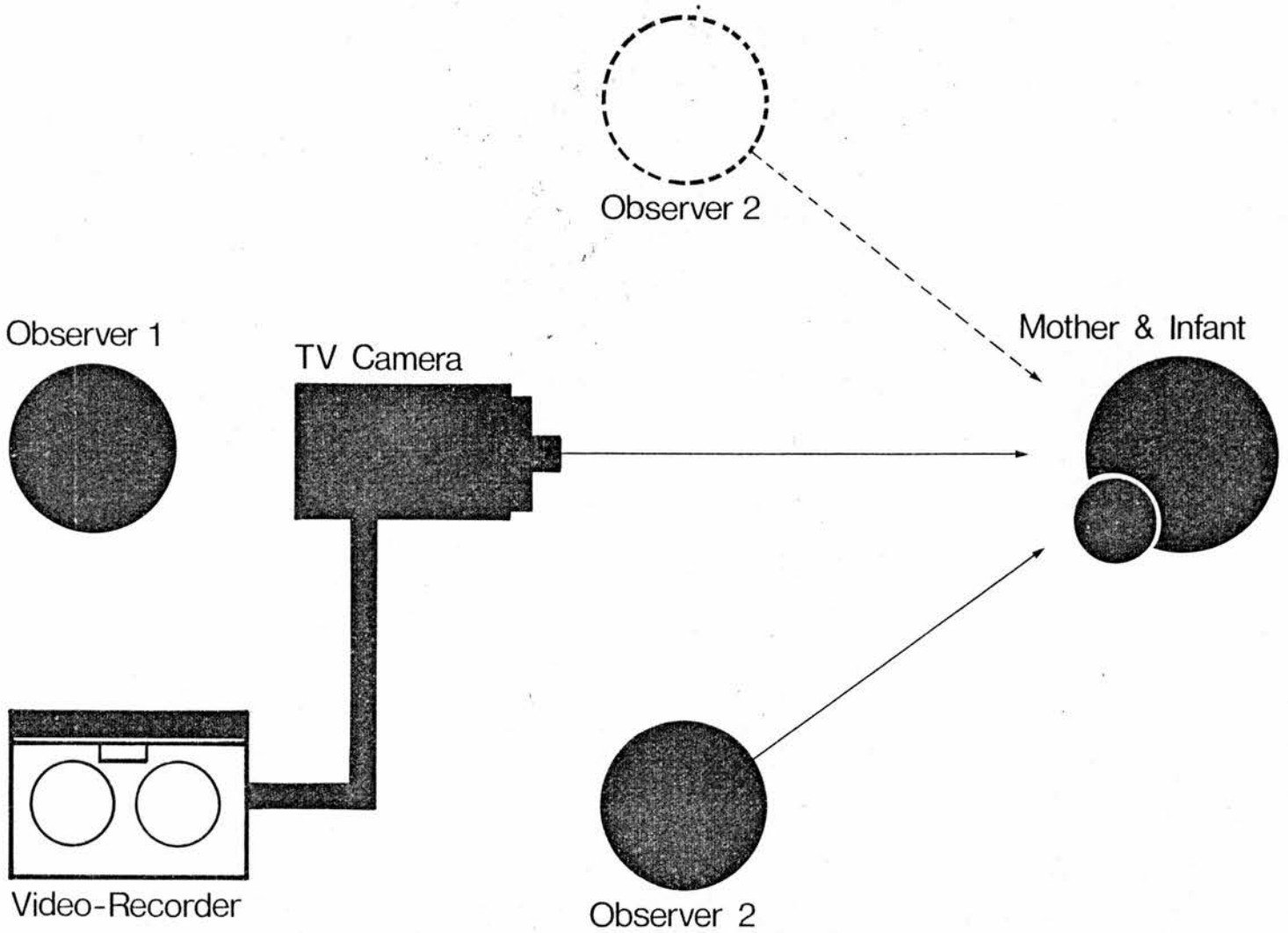
Filming took place either in the ward of the Maternity Hospital or in the home. Each session lasted from approximately three quarters of an hour to two and a half hours. Except in WEEK 1, before each feed, the anthropometric measures were taken. This was an attempt to standardise the conditions surrounding the filmed feed. Also, mothers were asked not to bath their infants before

the feed to avoid the introduction of factors which might influence the conditions preceding the feed. The room chosen for filming was that most appropriate to the mother. In the home, it tended to be the living room, whilst in the ward, where possible, a single side-room was made available. The layout for the film session is shown in Figure 3.1. (See page 79).

(c) Behavioural Analysis: General Considerations.

The categories of behaviour were defined during the two periods of observation preceding the main study. All the behaviours, including spoon feeding aspects, are presented in Chapter 4. The next step was to establish how best to score the behaviour such that its signal value could be studied and such that one could capture the developmental aspects of the skills involved in feeding. Considerations included methods of sampling to be used and the characteristics of the behaviour to be recorded. The choice was essentially between whether to regard the behaviours as events or states. (Altmann, 1974). Events provide one with an opportunity to ask questions about the frequency, and states about the duration of a behaviour. So the first task was to examine the records of the feed to look for ways in which the behaviours could best be characterised. The choice ultimately depends upon the questions being asked. Thus the next stage was to clarify how answers about the nature of behaviour as a signal could be sought. From the observations it seemed that answers about behaviour as a signal could be approached by asking whether behaviours occurred consistently at any place in the feed, and whether these behaviours were related to the receiver's behaviour in any consistent way. What was thus required was a record of the frequency with which behaviours occurred, the sequence in which they

FIG 3.1 Arrangement for the filmed session



Recording mother-infant interaction

occurred and their place in the feed.

To record the frequency it was decided that because the behaviour concerned could be circumscribed within a reasonably short time interval, the best strategy might be to record all occurrences of the relevant events. However, since the sequence of mother-infant behaviours was also required, before a final decision could be made, video-records of the feeds were sampled for possible instances when the two requirements led to an incompatability in recording techniques, (e.g., behaviour of one participant being of a longer duration than that of the other so that relatedness of behaviour became obscured). None were discovered.

Then, to score these behaviours in the form in which they were wanted, a check sheet was devised so that using the paper and pencil method, the data could readily be obtained from the video-taped records. After several trial runs the form was so devised that it consisted of a list of pre-coded infant behaviours to be scored each time they occurred, in columns representing the place in the feed, and numbered to maintain the sequence. Mothers' behaviours were scored as they occurred, either in relation to the infant behaviour or when they occurred independently of any apparent infant behaviour. The independent behaviours were included in the Numbered Sequence. (See Appendix II for checksheet). A more thorough analysis of the conceptual and methodological issues involved are presented in Chapter 5 and Chapter 6 together with a more detailed description of the specific methods used.

The Author carried out all the preliminary period of

observation, all the filming, scoring and subsequent analysis of the pilot study, all the filming in the main study and the subsequent analysis. Scoring for the main study was carried out by an assistant under the guidance of the Author.

CHAPTER FOUR

BEHAVIOURAL CATEGORIES OF FEEDING IN INFANT AND MOTHER OBSERVED FROM INFANT'S BIRTH TO SIX MONTHS OF AGE.

(Behavioural categories marked with an asterisk are these which have been used in this thesis).

A. INFANT CATEGORIES.

UNITS INVOLVING EYE LIDS.

1. EYES WIDE OPEN: Usual position of lids when the eyes are open (Brannigan and Humphries, 1972).

2. HALF CLOSED: Lids are midway between open position and closed position, from open position.

3. HALF OPEN: Lids are midway between open position and closed position, but opening from closed position.

4.* EYES CLOSING: Lids closing, only opening slightly in sequence with a sustained closed position, in contrast to a blink. Often accompanied by a glazed look.

5. EYES CLOSED: Lids remain closed.

6. OPEN/CLOSE SEQUENCE: More pronounced open/close sequence than in blink, present most frequently when infant moves from state 3 to state 4.

UNITS OF GAZE DIRECTION.

7. LOOK AT: Gazes in direction of person, object.

8. LOOK AWAY: Gaze directed away.

9. LOOK AROUND: Gaze directed around with no specific focus of interest.

10. EYE-CONTACT: Mother and infant looking into each other's eyes at same time.

11. FOLLOWS VISUALLY: Follows object or person visually.

12. LOOKS INTENTLY AT OBJECT: Usually food source, bottle, cups, spoon with fixed stare, still face and wide open eyes.

UNITS IN MOUTH REGION.

13. MOUTH OPEN: Lips wide apart and mouth held in position momentarily.

14. MOUTH CLOSED BUT NO FOOD IN MOUTH: Lips together, relaxed.

15. MOUTH '0' SHAPED: Mouth open, lips in '0' shape, lips not contracted.

16. SUCKING MOUTH POSITION: Top lip protrudes, bottom lip pulled straight slightly inset from top lip.

17. MOUTH CLOSED, LIQUID IN: Lips together, drawn inwards, lower lip slightly protruding.

18. MOUTH OPEN, LIQUID FOOD IN: Mouth open, tongue curled upwards, and occasionaly tongue comes out of mouth. Mouth often opened - close-opened in rhythmic movement.

19. MOUTH CLOSED, FOOD SWUNG ROUND MOUTH: Lips together, uses tongue to move food around in mouth, cheeks held in one position, tongue root moves visibly beneath chin.

20. LIPPING: Lip movements including lip stretching, not associated with food giving.

21. TONGUEING: Movements of the tongue protruding between lips that are nearly closed. (Korner, et al, 1968).

22. SPONTANEOUS SUCKS: Sucking movements that occur when the infant has no nipple or equivalent in the mouth (Korner et al, 1968).

23. MOUTH SEARCH: Side-to-side movements of the head or a single directed turning movement with the mouth opened; hands may be brought upwards level with the head. It sometimes occurs as a consequence of hand-to-mouth contact, accidental contact with various objects of clothing, or even spontaneously. (Similar in form to rooting movements described by Prechtl (1958)).

UNITS IN SUCKING

24. SUCKING MOVEMENT: Visible up and down movement of infant's jaw with mouth closed in '0' position and tongue moved up and down. Suction can be seen by mouth position and movement of cheeks.

25. CONTINUOUS SUCKING: Infant sucks without any breaks in the stream of sucking movements other than to restart the next suck.

26. SUCK-PAUSE PATTERN: Infant sucks in bursts which are separated by intervals longer than the established inter-suck interval of one second. (Wolff, 1968).

27.* CHANGES IN SUCK PATTERN:	Includes the appearance of a pause, the establishment of a suck-pause pattern, the lengthening of the pauses within the suck-pause pattern and any observed change in the sucking rate.
28.* STOPS SUCKING:	Infant releases hold on the nipple or teat, mouth is closed and no further sucking is engaged in spontaneously although nipple/teat remains in the mouth.
29.* POOR APPLICATION TO NIPPLE:	The lips are not in good enough contact with nipple /teat, so that milk trickles out of the side of the mouth and the sucking movement is not sustained with the mouth closed in '0' position.

UNITS DEFINED BY HEAD MOVEMENT.

30. HEAD TURNED TOWARDS MOTHER:	Can be with or without sucking movement, but is a directed movement.
31. HEAD TURNED AWAY FROM MOTHER:	Directed movement of head from facing mother to head turned away from mother.
32. HEAD TURNED SIDE-WAYS:	Head turned from face forward position to free sideways; that is not a directed head movement towards mother.
33. HEAD TURNED IN DIRECTION OF FOOD SOURCE, (cup or spoon)	Head turned toward food.
34. HEAD PUSHED FORWARD:	Head poked in the forward position with eyes wide open, often associated with interest in an object.
35. HEAD THROWN BACKWARDS WITH BACK ARCHED, EYES OPEN OR CLOSED:	Frequently occurs as a negative response to the offer of food.
36. HEAD DROPS:	Head allowed to fall, often occurring when infant becomes drowsy during a feed. During breast feeding, nipple is lost in the process and results in the infant falling off the breast.

UNITS IN HAND ACTIONS.

37. HAND TO MOUTH:	Either hand touches any part of mouth during activity when infant makes an effort to maintain contact with a suck (Korner et al, 1968).

38. HANDS TO FACE: Either hand touches any part of the face, excluding the mouth region, during activity.

39.* FINGER SUCKS: Finger (or fingers) actually inserted in mouth and more than two sucks accomplished. May follow mouth search activities.

40. HAND KNEADING: Occurs when infant is feeding, when fingers are moved in-out at breast or bottle, or mother's hand, or own body, or in 'air'.

41. HANDS AND ARMS TOWARDS FACE REGION: Both hands and arms are first moved, usually in unison, into a central position vis-a-vis face and then voluntarily brought towards face region. This is a different movement from the agitated hand-to-mouth movements in the neonate, and usually not seen until about three months.

42. HANDS AND ARMS AWAY FROM BODY: Hands and arms are jointly moved away from the body giving the appearance of a push. Usually seen as part of a negative response to food.

43. HAND FEED: Hand (or hands) moved to spoon, bottle or dish, and then brought to mouth. May or may not be followed by insertion but accompanied by visual attention and mouth opening.

44. HAND EXPLORING: Hand (or hands) with outstretched fingers moved in direction of objects within reach of bottle, mother's face, mother's fingers, breast, cup, spoon. Accompanied by visual inspection and carried out whilst feeding.

45. HANDS OUTSTRETCHED IN DIRECTION OF OBJECT BEING VISUALLY STUDIED: Fingers stretched out and expanded (palm uppermost). This is in contrast to hand feed but more akin to an anticipatory hand explore.

46. HAND POISED: Hand movement, fingers outstretched, palm downwards. Index finger pointed, small finger movements curling and uncurling.

<u>UNITS IN GENERAL ACTIVITIES.</u>

47. TOES CURL: Toes moved up and down, occurring most frequently when infant is feeding.

48. LEG KICKS: Legs moved up and down, bending at knees.

49. GENERAL ACTIVITY: Movement of arms and legs in a co-ordinated or as a synchronized activity.

UNITS IN VOCALISATIONS AND STATES.

50.* CRY/PROTEST: Crying, involving reddening and contorting of the face, and sometimes accompanied by tears.

51. FUSSING: Less sustained crying with less reddening and contorting of the face.

52. GRIZZLES: Negative response which is not a cry or fuss but the infant screws up it's mouth, half closes eyes and emits long drawn out 'uhs'; may or may not terminate in fussing and crying.

53.* BURPS: Expulsion of air, accompanied by an appropriate sound.

54. COUGHS;

55. SNEEZES:

56. OOGH/UM/ AH SOUNDS: Positive vocalisations which are accompanied by hand waves, smiles or general excitement.

UNITS IN FACIAL EXPRESSIONS.

57. FROWN: Eyebrow region puckered and drawn towards nose region.

58. SURPRISE: Eyes opened wide, face still, raised eyebrows.

59. CONCENTRATED FACE: Frowns with eyes fixed straight ahead, with blank look, and infant still.

60. GRIMACE: Lips drawn back and curled downwards, often accompanied by closing of eyes.

61. SMILE: Lips together but not compressed, drawn up and out at the corners. Similar to simple smile defined by Brannigan and Humphries (1972).

62. SAVOURS: Food in mouth, accompanied by a concentrated face with movements of the tongue. There may also be dribbling from the mouth.

UNITS IN BREAST/BOTTLE FEEDING.

63.	ELICITED MOUTH OPEN:	Teat or nipple moved over the infant's lips once or several times, followed by mouth open.
64.	SPONTANEOUS MOUTH OPEN:	Mouth open independently of any object touching lips, but not as a result of any observed voluntary anticipation of food approach.
65.*	REFUSES TO OPEN:	Nipple or teat moved over the infant's lips once or several times, but infant's mouth remains closed.
66.*	COMES OFF:	Infant is observed to withdraw head from the breast, releasing nipple. In the early months as withdrawal is less apparently voluntary, can be sub-divided into a further category of FALLS OFF.
67.*	SPITS TEAT OUT:	When bottle teat is in the mouth, infant actively expels it often incorporating some action of the tongue. Similar activity described by Gesell and Ilg, (1937)
68.	ANTICIPATORY MOUTH OPEN:	With breast or bottle in view and looked at, the mouth is opened as breast or bottle approaches.
69.	ARM AND MOUTH ANTICIPATORY MOVEMENTS TO BREAST/BOTTLE:	Bottle or breast in view, hands outstretched for bottle/breast when within reach (or when out of reach). Mouth opened as food source approaches.
70.*	TONGUE OBSTRUCTS TEAT INSERTION:	Tongue is placed in roof of mouth when mouth open so that teat is underneath it; called FAILS in description of infant's skill related to STARTS (Chapter 7).
71.	VOCALISES TO SIGHT OF BOTTLE:	Cries turn to squeals, hands moved in and out, mouth may be closed or open.
72.	VISUAL ATTENTION OF BOTTLE/BREAST DURING THE FEED:	Infant looks at bottle/breast which may or may not be accompanied by hand exploration.
73.*	POSSETS:	Small amount of food regurgitated but not actively expelled (as in vomits). Often a sequel to burps, and milk usually dribbles out of the mouth.
74.*	VOMITS:	A larger amount of food actively ejected from the stomach.

75.* HICCOUGHS: Involuntary spasm of respiratory organs with a characteristic sound.

76.* CHOKE: Temporary obstruction to breathing, often accompanied by a cough.

UNITS IN SPOON FEEDING.

77. SPOON APPROACHES BUT NO VISUAL ATTENTION: Although infant gives the appearance of attending to the feed, the spoon is not followed visually.

78. CRYING WHEN SPOON OFFERED BUT SPOON ACCEPTED: Spoon not followed visually as infant crying, spoon touches lips, mouth opened in bout of crying, spoon touches tongue, crying stops, mouth closes.

79. SPOON FOLLOWED BUT NO FOOD DIRECTED RESPONSE MADE: Spoon looked at, followed to mouth. No mouth opening or expressive actions given.

80. ANTICIPATES SPOON BUT MISSES CONTACT WHEN SPOON REACHES MOUTH: Watches spoon approach, opens mouth before spoon reaches lips then moves head sideways out of alignment in a directed movement as spoon reaches the mouth.

81. ANTICIPATORY SPOON ACTIONS INCLUDING VOCAL SIGNS: Spoon followed visually, mouth opened before spoon reaches lips accompanied by vocal sounds of 'oh','ah' and arm waving. Mouth closed if spoon does not arrive within a short time.

82. ADVANCED ANTICIPATORY SPOON ACTIONS: Spoon followed, mouth opened as soon as spoon approaching, opening sustained until spoon reaches mouth. Head kept still and mouth only closed when spoon in mouth.

83. HAND AND MOUTH ANTICIPATORY ACTIONS: Food source looked at and hand reached out towards spoon, brings spoon towards mouth. The act may or may not be successful.

84. SPOON-ROOT-MOUTH OPEN: Spoon touches lips, infant roots and opens mouth. In the process the spoon can lose it's alignment with the infant's mouth.

85. SPOON IGNORED: Spoon touches lips, infant carries on with previously engaged in activities, no acknowledgement of spoon's presence, e.g., no mouth opening, no visual attention.

86.	SPOON INSPECTED WHEN TOUCHES LIPS:	Spoon not looked at during approach, but when touches lips mouth opened accompanied by visual inspection.
87.	FOOD SUCKED OFF SPOON:	Spoon placed at lips, mouth opened only as food sucked off spoon in rhythmic suck like movements followed by suck-swallow movements in temporal sequence visually similar to suck-swallow pattern found in milk feeding.
88.	CHEWING OF FOOD WHEN SPOON OFFERED:	Spoon held between lips, mouth movements of a small chewing type pattern; no immediately accompanying swallowing.
89.	FOOD PASSED AROUND MOUTH:	Infant stares ahead, emits vocal sounds of 'um-ah', and food passed around mouth by tongue movements. Tongue is curled upwards with mouth opening and closing rhythmically, tongue occasionally comes out of mouth. Sometimes food then spills out around mouth.
90.	NEGATIVE RESPONSE TURNED TO A POSITIVE RESPONSE:	Infant crying whilst spoon in mouth; spoon pushed further in and held in one position, infant stops crying then makes up and down mouth movements.
91.	SPOON REFUSED:	Spoon touches lips and mouth not opened, rather head moved sideways and may be accompanied by back arching, fussing or crying.
92.	FOLLOWS SPOON WHEN IT IS REMOVED:	Spoon followed as it is placed in the cup, but continues to chew.
93.	NO RESPONSE TO SPOON REMOVAL:	Spoon removed but not followed visually. Nor is it accompanied by a negative response. Rather the mouth is held in the same position as when the spoon is in the mouth.
94.	NEGATIVE RESPONSE TO SPOON REMOVAL:	Spoon not followed when removed but infant starts agitated cry often accompanied by hand-to-mouth movements.
95.	POSITIVE RESPONSE TO FOOD ON SPOON:	Food taken amidst arm waves, leg shakes and 'oh's and ah's, with eyes dancing and face bright and alert.
96.	INTEREST IN FOOD SOURCE FOLLOWING SPOON REMOVAL:	Following spoon removal infant watches mother prepare the next spoon, regards food source (cup or plate) with fixed gaze, eyes bright, mouth movements frequently accompanying this activity, and often hand waves, feet kick and positive vocalisations.

97. FOOD REJECTED: Following acceptance of food from spoon, food blown or spat out.

B. MOTHER CATEGORIES.

UNITS OF GAZE DIRECTION.

98. EYE-CONTACT: Mother looks into the infant's eyes when infant is looking at mother's eyes.

99. LOOK AT: Gaze directed at infant including face, body and hands.

100. INSPECTS INFANT: Mother visually inspects infant, regarding head, hands, feet and general position. It is different from LOOKS at, as it entails more of a search like activity.

101. LOOK AWAY: Gaze directed away from infant.

102. LOOK AROUND: Gaze wanders, usually around the room, at other people, or out of the window.

UNITS RELATED TO POSITION OF INFANT DURING FEED AND PRESENTATION OF FOOD.

103.* POSITIONS BREAST: Removes covering and allows breast to hang freely so that nipple is available for the infant to fix on.

104.* LIFTS BREAST: In helping infant to fix, mother uses her free hand to lift the breast so that the nipple reaches the infant's mouth. Once the infant is sucking, mother releases the nipple and it can then fall so that the infant looses it.

105.* FLATTENS NIPPLE OF BREAST: Either mother puts her index finger and third finger on either side of the nipple and presses them into the surrounding areola tissue so flattening the nipple; or mother pushes the infant on to the nipple so that it becomes flattened. In both instances the nipple is subsequently not graspable.

106.* GOOD POSITION OF INFANT FOR BREAST FEEDING: Infant is cradled in the crook of mother's arm on same side of breast from which infant is feeding. Infant held more or less horizontally. Head is supported so that it does not fall away from breast, lower jaw has space for free movement, infant's nose is not obstructed and body movement is not inhibited.

107.* GOOD POSITION FOR INFANT DURING BOTTLE FEEDING: Infant is supported by mother, so that head is supported, there is space for the lower jaw to have freedom of movement and the infant's body is not restricted. Held in semi-recumbent position.

108.* INFANT'S HEAD NOT SUPPORTED: Mother places infant in breast feeding position/bottle feeding position, so that head has no support. When infant is not old enough to support head, it falls backwards.

109.* INFANT'S NOSE OBSTRUCTED DURING BREAST FEED: Mother places infant at the breast such that head is pushed on to the nipple whereby the nose becomes obstructed by the breast tissue. On some other occasions when the breast is pendulous and fat, even though infant is positioned freely at the breast, the nose becomes obstructed by the breast tissue.

110.* INFANT'S LOWER JAW OBSTRUCTED: Infant so supported that body becomes squashed with head pressed on to chest thus restricting freedom of movement for lower jaw.

111.* INFANT'S BODY RESTRICTED: Mother holds legs and arms in such a way that they are 'pinned' in one position and the rest of the body is held so that it curves awkwardly inhibiting natural movement.

112.* NIPPLE IN ALIGNMENT: Mother keeps nipple so that it is in line with the infant's head directed movements.

113.* MOTHER FAILS TO SYNCHRONIZE WITH INFANT: Infant engages in head directed movements but mother does not keep nipple in one position. When infant makes grasping mouth movement, the nipple is out of reach usually above the upper lip level of the infant's mouth.

UNITS OF MOTHER ACTIVITY INVOLVED WITH INFANT FEEDING.

114.* STIMULATION TO SUCK: When the mother touches the infant's head region or manipulates the bottle or breast such that the action is directed at encouraging the infant to feed. It includes stroking of the cheek, pushing the chin in an upward direction, pulling or pressing the breast around the areola area, moving the teat of the bottle up, down, sideways or around the infant's mouth, shaking the bottle or allowing the head of the breast feeding infant to fall away from the breast so that the nipple has to be more firmly grasped if it is to be retained.

115.* MINIMUM STIMULATION: Only carried out once or twice within a period of the feed.

116.* TERMINAL STIMULATION: Only carried out at the end period of the feed.

117.* REPEATED STIMULATION: Carried out frequently, at least once within each burst of sucking.

118.* TEAT IN-OUT SEQUENCE: An activity carried out by bottle feeding mothers when the teat is pulled out of the infant's mouth and immediately pushed back in; a more disruptive form of stimulation and infant may or may not open mouth spontaneously at re-insertion of teat.

119.* NIPPLE/TEAT OVER LIPS: Mother strokes the infant's lips with the teat or nipple, once or several times forming one sequence of events. It is used as a "testing" procedure to see if infant will open mouth, or to allow infant to open mouth prior to a period of sucking.

120.* OFFERS NIPPLE OR TEAT: Places the teat or nipple ready for the infant to accept, does not push nipple or teat in infant's mouth, nor strokes infant's lips. Waits for infant to open mouth spontaneously.

121.* PUTS INFANT ON BREAST: Mother places infant in feeding position, waits for infant to open mouth and then places nipple in infant's mouth.

122.* PUSHES TEAT/NIPPLE IN: Mother pushes teat/nipple into infant's mouth when closed; can be preceded by pulling the infant's lower jaw downwards to forcibly open the infant's mouth.

123.* DECIDES TO FINISH: Mother stops the feed on the basis of the infant's behaviour such as REFUSES to OPEN, COMES OFF, SPITS the TEAT OUT and rarely STOPS SUCKING.

124.* PAUSES: Mother remains still, following an infant behaviour.

125.* APPROPRIATE ACTION TO CHOKES AND RETCHES: Stops feeding and supports infant so distress is not aggravated.

126.* APPROPRIATE ACTION TO ORAL BEHAVIOURS: Offers further food.

127.* APPROPRIATE ACTION TO POTENTIAL INFANT SATIETY SIGNALS: Stops the feed.

UNITS OF ACTIVITY INVOLVED IN INTERRUPTIONS DURING MILK FEED.

128.* WINDS: Mother sits infant forward on her knee and rubs the infant's back or pats the back; or lifts the infant over her shoulder accompanied by rubs or pats, or lies infant in prone or supine position across her knee then raising to sitting position followed by rubs or pats.

129.* CHANGES THE BREAST:

130.* TAKES OFF NIPPLE: (breast) Mother places her finger in the infant's mouth and then prises the infant's gums apart so that the hold on the nipple is lost. The infant may be sucking or pausing.

131.* REMOVES TEAT: (bottle) Mother pulls teat out of infant's mouth. Described as appropriate if infant has stopped sucking; inappropriate if infant is still sucking; and leading to a disturbed feed if done repeatedly whilst infant was sucking.

MISCELLANEOUS MOTHER-INFANT CATEGORIES.

132.* SOOTHES: Repetitive side to side movements accompanied often by stroking of infant's body, or talking in a quiet voice. Infant usually held vertically in mother's arm, close to her own body.

133.* COMMENTS: Mother makes remarks specifically about infant behaviour currently engaged in; content of speech used to determine relevance of research.

134. SMILES AT INFANT: Mother smiles specifically when looking at infant and within three feet of the infant even if the infant's eyes are closed. (Richards and Bernal 1972).

135. TALKS TO INFANT: Mother talks to infant other than commenting on behaviour, and the content of speech is used to determine whether or not speech is directed at the infant.

C. MILK FEED CATEGORIES.

136.	START:	An initiation of a feed, followed by feeding.
137.	TEST-START:	Mother tests infant's willingness to open mouth through oral stimulation around lips but feeding is not continued.
138.	ABORTIVE START:	Nipple or teat goes into infant's mouth, but is then immediately or shortly lost.
139.*	BEGIN TO FEED:	First quarter of feed, feed defined as teat in to teat out.
140.*	MIDDLE OF FEED:	Half of feed that lies between beginning and end of feed.
141.*	END OF FEED:	Last quarter of feed, to teat or nipple out.
142.	AFTER:	Occurrence of feed orientated behaviours, after the teat/nipple is out for the last time.
143.*	DISTURBED FEED:	A feed when the infant's sucking is repeatedly interrupted or impeded by mother's behaviour, most frequently occurring independently of the infant's behaviour.
144*	PUTS SELF ON:	Breast feeding infant turns towards breast, puts self in feeding position and grasps nipple alone to feed.

CHAPTER FIVE

INFANT EXPRESSIVE BEHAVIOURS AND THEIR POTENTIAL SIGNAL VALUE DURING A FEED.

5.1 INTRODUCTION.

For behaviours to be said to indicate a state, the infant must have the capacity to produce actions that clearly indicate the appropriate state. If these actions are then to be described as signals they must also be capable of transmitting information about state. An important issue that arises when attempting to establish whether signals actually indicate a state thus concerns the definition of a signal.

In defining a signal, MacKay (1972) has said that for a behaviour to be responded to or act as a signal does not necessarily imply that the behaviour need be goal directed. All that is required is that the signal evokes a change in behaviour in the receiver. (Cullen, 1972). This is, however, a rather loose definition since it embraces a variety of ways in which a signal can function. There is, firstly, the distinction between whether a signal which may be an innate or learned action pattern results "reflexly" from some cause, or, is a signal with conscious intent. Secondly, signals may arise from several causes which are not themselves distinguished by the signal, in contrast to signals which are themselves specific arising from specific needs and directed to specific goals. Thirdly, there is a distinction between behaviours which have evolved specifically to have a signal function (overt signals) and behaviours, which are a consequence of some state, which did not evolve to have a signal function but which an observer can use (covert signals). Finally, even though the sender emits a signal there is the problem of whether the receiver responds at all or, if there is a response, whether this

is a "correct" response.

Thus the concept of a signal is not unitary. It produces many problems when developing operational methods of which only showing that mother responds correctly to remedy a specific need shown by a specific signal is at all straightforward. One real difficulty in a study of mother-infant interaction is exemplified in Dunn's (1975) observation that mothers have a tendency to give meaning to their infant's responses according to some independent criteria. This tendency confounds any interpretation attempted of the nature of infant signals which is based solely on the mother's responses, however consistent these may be. Even consideration of the context within which both partners' behaviour occurs will not necessarily get round the problem. Another difficulty is that shown by Lewis (1967) in his study of crying in infants. He found that behaviour can change its meaning at different ages. This could equally well occur within one feed, let alone over age. For example, infants may come off the breast during the course of a feed because something in the environment has attracted his/her attention. Whereas later in the feed, this same behaviour may be used to bring the feed to an end.

In this study the aim is to establish whether the infant has the ability to signal satiety. The definition chosen was limited to that of whether a behaviour has the potential to act as a signal; the potentiality being based on whether the infant behaviour was shown to occur during satiety by evoking a change in mother's behaviour. It has, therefore, limited the level of description possible specifically to the form and frequency with which the potential signals occur since other important aspects in which signal's function are ignored. In the discussion of the results, therefore, only speculation can be made/ regarding

features of a signal other than their form and frequency.

In order to capture the infant's ability to signal satiety one first had to select behaviours which might have the potential to act as expressive behaviours. It has already been suggested from studies mainly carried out in the laboratory, that in the neonate, expression of hunger is signalled by crying (Wolff 1969), and spontaneous sucking, tonguing, chewing (Korner et al 1968) and the expression of satiety by falling asleep (Gesell and Ilg 1937; Peiper 1961), increase in pause length between sucks (Peiper 1961; Dubignon and Campbell 1969), and refusal to open the mouth (Dubignon and Campbell 1969). After the neonatal period, crying is said to differentiate as a signal indicating a response to taste and texture so showing a subtle change in the way it is used as a protest if food is withdrawn when hunger remains (Wolff 1969). Satiety is thought to be reflected in the breast-fed infant taking himself off the breast and in the bottle and breast fed infant taking an increased interest in their surroundings and frank refusal accompanied by arching of the back. (Gesell and Ilg, 1937). So that during the pilot study these various behaviours were used as an initial basis upon which a behavioural category of potential signals might be built. The only exception to this was the behaviour described as falling asleep. It had already been decided that events were to be scored and not states. This particular behaviour was, therefore, re-defined so that if it appeared in the infants observed, it would be captured through the behavioural events which it incorporated, e.g., EYES CLOSING. However, it soon became apparent that this initial list had not captured all the behaviours which were observed to produce a change in mother's behaviour. It was thus enlarged to incorporate those that had been missed. The final list contained the following

ten categories of infant behaviour: -

(i) Changes in Sucking Pattern;

(ii) Eyes Closing;

(iii) Stops Sucking;

(iv) Refusal to Open the Mouth;

(v) Comes off the Breast;

(vi) Spits the Teat of the Bottle out;

(vii) Oral Behaviours of Mouth Search and Finger Suck grouped because they tended to occur together.

(viii) Cry/Protest;

(ix) Choke;

(x) Burps, Possetts and Hiccoughs grouped together because they were invariably interrelated.

Definitions of these behaviours appear in Chapter 4. The varied forms in which sucking was observed were grouped together into one category because the method used for recording them was not found to be accurate enough for subtle differences to be scored reliably. It is, therefore, a rather crude measure. The other problem with the form in which the behaviours were chosen is that certain tactile cues between mother and infant such as differences in the strength of the suck or any resistance of the infant to the removal of the teat could not be captured. Thus, some potential cues available to the mother may well have been lost.

So, bearing in mind these various limitations outlined above, examination of the expressive ability of the infant and the potential availability of signals which may reflect motivational state were used to answer the following questions: -

1. In the natural setting, are there behaviours present which have this potential?

2. Does the expressive nature of these behaviours change during the first six months of life?

3. Are there any differences in expression between breast and bottle fed infants?

5.2 METHOD.

Motivational state, assessed independently of the behaviours that might express it, is always difficult to measure through avoidance of assumptions that inevitably reflect a circular argument. Since a Naturalistic Study cannot, by definition, artificially manipulate variables, this circularity is particularly difficult to avoid. So that whilst amount of food taken and length of feed describe different aspects of motivation, they of course assume that hunger diminishes in some direct relation to food taken or the amount of feeding activity. Thus, in an attempt to overcome this objection, when the infant stops feeding and will take no more food, it will be assumed that the infant has had enough and is satiated. Satiety is thus given an operational definition which does not include food ingestion or ingestion activities. It does, however, presuppose that 'satiety' exists on an all-or-none basis when no further sucking occurs. Satiety behaviours are then defined as those behaviours which occur when sucking has ceased at the end of the feed: it is these behaviours which have the capacity to become signals and in this study are the ones defined as potential satiety signals.

There are limitations even with this definition, however, because it does not satisfactorily get over the difficulty of determining why the infant will not feed any more. To presuppose that 'satiety' exists simply because no further sucking occurs is not without its difficulties as Gesell and Ilg (1937); Peiper (1961) and Dubignon and Campbell (1969) discovered. Even though causal analysis is not the purpose of this study, the problem of distinguishing empirically between fatigue and satiation remains unresolved.

Also, in the older infant, there is the possibility that a stop in feeding could be for some reason quite unconnected with food intake such as interest in surroundings. Competition thus occurs between two events. Hence there were further reasons for calling the satiety behaviours only potential signals of satiety. A more critical analysis incorporating detailed records of intake and interval between meals at least over a twenty-four hour period would be needed before one could satisfactorily hope to distinguish unambiguously between these various possible causes. So that in the discussion section, the interpretation given to satiety signals is again restricted. Whilst, in an attempt to establish the presence of behaviours which have the potential to act as signals of satiety, the study will be limited to showing that there are behaviours which occur more frequently at the time of satiety than at other times. But even this approach incorporates the problem that potential signals of satiety may occur at other times in the feed. It underlines the need for some independent criterion for defining satiety which avoids any concept of declining hunger. If behaviours found frequently after the end of feeding also occur with increasing frequency during the progress of the feed, this implies that they also express increasing satiety during feeding.

The data is taken from the video-tape recording of the feeds, using the paper and pencil method of scoring. The check list designed to allow ease of recording both sequence and place in the feed is presented in the Appendix (Appendix II). All occurrences (but not duration) of the selected behaviours are scored and the sequence maintained by numbering each behaviour as it occurs. Place in the feed is determined by dividing the feed into beginning, middle and end. The total feed time is from when the teat or nipple first enters the infant's mouth until the last time it is removed. The

beginning of the feed then becomes the initial quarter of the feed, the middle, half of the total feed time between the beginning and end section, and the end the last quarter of the feed. Time of the feed only included the milk feed. Adjustments in time were made to take account of the few occasions in some older infants when a spoon was offered in the middle of a milk feed, so that there was no imbalance in the frequency with which behaviours occurred according to place in the feed. This method of division by place in the feed was adopted to control for variations in the length of individual feeds and to allow for comparison between bottle and breast feeding. It does have the disadvantage that it ignores possible differences in technique reflected particularly in the fact that in breast feeding the infant actually changes side and, because of known differences in the constituents of fore and hind milk (Hytten 1954) may experience a change in the taste of milk consumed. However, whatever the method of comparison used, this same criticism would apply as it is a feature specific to breast feeding. It therefore becomes a contributory factor that must be considered not only when accounting for differences between the two modes of feeding but in any situation where changes in milk composition may affect outcome.

By choosing the paper and pencil method in preference to an event recorder, it has meant that the sequence of events is retained but not the absolute time interval between each behaviour. This reflects the original decision made to record events and not states. This raises another methodological issue because satiety is a state and not an event. A behavioural state may be defined in two ways:-

1. By the simultaneous combination of different items of behaviour. This is a formal global description of behaviours resulting from the overall combination of internal states each giving rise to specific behaviour; and

2. Through the particular combination of those behaviour items which arise from a specific internal state of the animal.

In this situation, the state common to those behaviours has to be deduced from the frequency with which they fluctuate together. This may either be simultaneously or in a lawful temporal sequence.

The reason for only retaining the sequence of behaviours and not the time interval were twofold. Firstly, because only selected behaviours were being scored, a cluster analysis or a sequence analysis bound by time was thus rendered invalid. Secondly, because during the course of the feed not all activities are always related to the process of feeding, further difficulties were apparent. It became obvious from the video-tape record that a sequence or cluster analysis could include a number of potentially unrelated behaviours. One was in danger, therefore, of introducing methodological artefacts. Hence the interest focussed on only selected infant behaviours which followed one another; intervening activities which appeared to the observer to be unrelated to feeding were excluded. But in choosing this method, it has meant that neither method of defining satiety could be used. One way around the problem might have been to define the beginning and end of a particular behaviour, keeping a record of the time when they occurred within the total observation period. This would have given the temporal measure required. Because there may be delays between causally related acts (when the contiguous acts are not, therefore, related), the timing of the acts both within and between the individuals is important for any study of interactions. The only way in which the relationship can be found is by temporal correlations or first, second and even third order or more transitions.

In this study, therefore, the assumption that was adopted was that, despite the time interval between two <u>infant</u> behaviours, if one

behaviour is shown to be consistently followed by another, the record is regarded as an outcome of the first. For example, if the breast fed infant comes off the breast and then refuses to open its mouth when reoffered the breast, even if mother has winded or interrupted the sequence in some other way, so delaying the interval between the two behaviours, the sequence reflects a consequent even if shown to occur consistently. The COMES OFF may then be said to have the potential to act as a signal of satiety, as may REFUSES TO OPEN.

Unfortunately, despite the rationale underlying the choice of method, it has not avoided the fundamental problem of attempting to impute a state from behavioural events. It does, however, highlight the limitations of the technique developed in this study (to record the behaviour). In any future study other recording techniques might be explored. As Vowles (1975) has shown, there are several automatic event recorders available. The 'Wrats' system (White's recording and transcription system) is one where simultaneously occurring behaviours can be recorded and has a timing system. It is, therefore, as a device, able to cope with complex activities so allowing for a sophisticated analysis through appropriate computation. The time sampling technique can then be used to assess change in state as it is able to capture those behaviours which occur together, those in close temporal relationship and those separated by other 'unrelated' behaviours (Vowles 1975). The patterning of behaviour or the clusters of behaviour reflecting state could then have been described thus increasing the construct validity of the method employed.

Inter-observer reliability scores reached above 75% for all behaviours, including those reported in Chapter 6 (See Appendix IV) Reliability was established by comparing the scores of two observers

recording the same video-taped feeds independently The percentage is calculated from the following formula:-

$$\frac{N_{A+B}}{N_A + N_B} \times 100\%$$

Where N_A = number of times the behaviour was recorded by observer A;

N_B = number of times the behaviour was recorded by observer B;

N_{A+B} = number of times observer A and observer B recorded the same behaviour within the time intervals defined.

5.3 PRESENCE OF INFANT BEHAVIOURS.

Before embarking on any detailed analysis of the nature of behavioural expression during a feed, it is first necessary to establish that behaviours occur in a high percentage of infants. The percentage of infant behaviours showing each of the ten categories of behaviour was thus assessed at each age level. From Table 5.1 it can be seen that whilst all the behaviours do appear, the degree to which infants show them seems to vary according to age and technique.

The behaviours observed most reliably in the majority of infants at whatever age were CHANGES IN SUCK PATTERN, (100% at all ages); EYES CLOSING (more than 83% breast feeders except at WEEK 16, more than 67% of bottle feeders except at WEEKS 16 and 24), and COMES OFF, (more than 82% breast feeders).

STOPS SUCKING, REFUSES TO OPEN, CRY/PROTEST and BURPS, whilst occurring in a high percentage of infants, this percentage occurrence was not maintained over the first six months of life. STOPS SUCKING was most frequent in breast feeders at WEEK 1 (91%) but in bottle feeders at WEEK 8 (80%). REFUSES TO OPEN was most frequent in breast feeders at WEEK 4 (82%) but in bottle feeders at WEEK 1 (78%). CRY/PROTEST was most frequent in breast feeders at WEEK 12 (83%) and in bottle feeders at WEEK 16 (67%); and BURPS was most

TABLE 5.1

Percentage of Infants showing the Behaviours by AGE and FEEDING TECHNIQUE.

AGE IN WEEKS	Changes in SK. Pattern		Stops Sucking		Eyes Closing		Refuses to open		Comes Off		Spits teat out		Oral Behav-iours		Cry/ Protest		Choke		Burps.	
	Br.	Bo.	Br	Bo.	Br	Bo.	Br	Bo.	Br	Bo.	Br	Bo.	Br	Bo.	Br	Bo.	Br	Bo.	Br	Bo.
1	100	100	91	44	91	67	36	78	82	0	0	11	55	33	73	12	45	22	55	67
4	100	100	82	62	100	87	82	50	91	0	0	25	55	12	27	12	18	25	55	63
8	100	100	60	80	100	78	40	56	90	0	0	11	20	11	40	44	40	0	70	22
12	100	100	33	60	83	90	33	50	100	0	0	20	33	20	83	50	17	10	67	60
16	100	100	11	56	67	33	44	22	100	0	0	33	33	11	44	67	33	0	36	55
20	100	100	0	20	83	80	50	10	83	0	0	10	17	10	33	60	33	40	17	60
24	100	100	67	10	100	50	33	0	100	0	0	10	0	0	33	50	33	70	0	60

frequent in breast feeders at WEEK 8,(70%) and in bottle feeders at WEEK 1, (67%).

The behaviours which are shown by the smallest percentage of infants studied were SPITS THE TEAT OUT, ORAL BEHAVIOURS and CHOKE. SPITS THE TEAT OUT is something only bottle fed infants do and was present most frequently at WEEK 16 (33%). ORAL BEHAVIOURS were present most frequently in breast feeders at WEEKS 1 and 4 (55%) and in bottle feeders at WEEK 1 (33%); whilst CHOKE was present most frequently in breast feeders at WEEK 1 (45%) but in bottle feeders at WEEK 24 (70%).

A possible reason for the apparent differences in occurrence between the two techniques might be related simply to the fact that behaviours occur more frequently in one technique rather than another. To test this hypothesis, the total frequencies of all behaviours at all ages between the breast and bottle feeders were compared. As the prediction only holds up at WEEK 1 ($U = 1.5$; $p = .01$) and at WEEK 20 ($U = 10.5$; $p = .05$), it looks as though this is not the entire explanation. (See Table 5.2).

Alternatively, certain characteristics within the feed (such as the amount of milk consumed and the length of the feed) might be affecting the results. To test both these possibilities the number of behaviours shown by each infant was correlated separately with both these factors.

From the results for the correlations between the number of behaviours and the length of the feed, presented in Table 5.3; what emerges is that there is little evidence for any correlation in the breast feeding infants. The relationship is only significant at WEEK 4 ($r_s = .79$; $p < .01$). But there is a much stronger link in the bottle feeding infants, with significant correlations at WEEK 4

TABLE 5.2

Mean Frequency of Occurrence of Behaviour by AGE and TYPE of FEEDING.

AGE IN WEEKS.	BREAST		BOTTLE		Significance Value
	Mean	Standard Error	Mean	Standard Error	
1	23.18	1.73	11.67	2.17	p = .01*
4	21	2.56	18.37	3.94	NS
8	18.7	2.68	14.56	2.20	NS
12	16.33	2.76	11.80	2.39	NS
16	11.89	1.21	9.89	1.62	NS
20	11.67	1.65	7.80	0.81	p = .05*
24	11.33	1.33	7.20	0.99	NS

* Mann-Whitney U Test, Two-Tailed Test, (Siegal, 1956).

TABLE 5.3

Correlation between frequency of Infant Behaviours and length of feed.

AGE IN WEEKS	BREAST	BOTTLE
1	r_s = .12 NS	r_s = .13 NS
4	r_s = .79 p <.01 *	r_s = .66 p <.05 *
8	r_s = .28 NS	r_s = .87 p <.01*
12	r_s = -.28 NS	r_s = .82 p <.01 *
16	r_s = .03 NS	r_s = .63 p <.05 *
20	r_s = -.26 NS	r_s = .21 NS
24	TOO FEW TO EXAMINE	r_s = .15

* Spearman Rank Correlation, One-Tailed Test, Corrected for Ties. (Siegal, 1956)

(r_s = .66 p <.05); WEEK 8 (r_s = .87 p <.01); WEEK 12 (r_s = .82 p <.01) and WEEK 16 (r_s = .63 p <.05).

Amount and number of behaviours shown, produces a rather different picture. There is no significant relationship this time in the bottle feeding infants, but there is in the breast feeding infants at WEEKS 1,8 and 16. However, the nature of this relationship is inconsistent. At WEEK 1 and WEEK 8 the correlation is negative. (WEEK 1 r_s = -.6 p <.025; WEEK 8 r_s = -.56 p <.05) but positive at WEEK 16 (r_s = .79 p <.01). These results are presented in Table 5.4.

It looks, therefore, as though there is a tendency for the frequency of the behaviour of the bottle feeding infant to be influenced by the length of the feed, but the behaviour of the breast feeding infant to be influenced by the amount of milk taken. The nature of this latter relationship, however, is somewhat more complex than the former since the direction of the effect does vary and in no obviously consistent way. What also appeared was that these two characteristics are probably independent factors, whatever their influence. This is reflected, not only in the differences found according to the technique,but also in the lack of any significant correlation between them, except in the breast feeders at WEEK 20 (See Table 5.5).

A third factor which could affect the general outcome is age. To look at this aspect, the overall frequency of behaviour, the amount consumed and the length of the feed, were examined according to age using the Friedman Two-Way Analysis of Variance. Because not all mother-infant pairs were filmed at every age group this analysis was limited. Only six breast-feeding infants were used, at the

TABLE 5.4

Correlation between frequency of infant behaviours and the Amount Consumed at the feed.

AGE IN WEEKS.	BREAST	BOTTLE
1	$r_s = -.6$ * $p = .025$	$r_s = -.39$ NS
4	$r_s = .45$ NS	$r_s = .24$ NS
8	$r_s = -.56$ * $p < .05$	$r_s = .44$ NS
12	$r_s = .72$ NS	$r_s = -.03$ NS
16	$r_s = .79$ * $p < .01$	$r_s = -.17$ NS
20	$r_s = -.31$ NS	$r_s = .08$ NS
24	TOO FEW TO EXAMINE	$r_s = .47$ NS

* Spearman Rank Correlation, One-Tailed Test. Corrected for ties. (Siegal, 1956)

TABLE 5.5

Correlation between Amount Consumed and Time of Feed.

AGE IN WEEKS	BREAST	BOTTLE
1	$r_s = -.09$ NS	$r_s = -.24$ NS
4	$r_s = .39$ NS	$r_s = 0$
8	$r_s = .25$ NS	$r_s = .56$ NS
12	$r_s = .03$ NS	$r_s = -.03$ NS
16	$r_s = -.3$ NS	$r_s = .12$ NS
20	$r_s = .86$ $p < .05$ *	$r_s = .41$ NS
24	TOO FEW TO EXAMINE	$r_s = .21$ NS

* Spearman Rank Correlation, One-Tailed Test. Corrected for Ties. (Siegal, 1956).

ages WEEKS,1, 4, 8, 16 and 20, and six bottle feeding infants for WEEKS 1, 4, 8, 12, 20 and 24. Care was taken, however, to include scores from the ages at which significant differences according to TECHNIQUE had already been shown, to reduce the possibility of any interpretation which might exclude these various factors. From the results it can be seen that age appears to be a significant factor in all three categories, whatever the technique. (See Table 5.6).

TABLE 5.6

RELATIONSHIP between AGE and FREQUENCY of BEHAVIOUR, AMOUNT CONSUMED at the FEED and the LENGTH of FEED.

	FREQUENCY of BEHAVIOURS	AMOUNT CONSUMED	LENGTH of FEED.
BREAST df = 4	$xr^2 = 10.77$ $p < .05$	$xr^2 = 11.43$ $p < .05$	$xr^2 = 15.73$ $p < .01$
BOTTLE df = 5	$xr^2 = 15.48$ $p < .01$	$xr^2 = 18.31$ $p < .01$	$xr^2 = 17.24$ $p < .01$

Friedman Two-Way Analysis of Variance. (Siegal, 1956)

So that, in general terms, it looks as though it can be said that there are behaviours present which have the potential to act as signals. But the frequency with which they occur probably depends on age, length of feed and amount consumed; with the interaction between the various factors varying according to the technique.

5.4 CHARACTERISTICS OF THE INDIVIDUAL INFANT BEHAVIOURS.

To look at the characteristics of each behaviour, their frequency of occurrence, place in the feed and their relationship with each other was then examined and compared according to age and technique.

The behaviours showing the highest mean frequency are those behaviours which are expressed by most infants. They are CHANGES IN

SUCK PATTERN (see Fig. 5.1. (Figs. 5.1 - 5.9: pp.109 - 113)), EYES CLOSING (see Fig. 5.3) and in breast feeders, COMES OFF (see Fig.5.5a). Four behaviours tend to be behaviours that more than 70% of infants express once or twice during the feed but only at certain stages in their development. These are STOPS SUCKING (see Fig. 5.2), CRY/ PROTEST (see Fig. 5.7) and BURPS (see Fig. 5.9). SPITS THE TEAT OUT (see Fig. 5.6b), ORAL BEHAVIOURS (see Fig. 5.6) and CHOKE (see Fig. 5.8) on the other hand, are also behaviours that tend to occur only once or twice during the feed, but unlike the four similarly occurring behaviours they are not behaviours which most infants express. They thus appear to be behaviours that reflect individual response forms rather than any general characteristic of feeding behaviour.

Having found differences in the frequency with which behaviours occurred, the next question that was asked was whether all behaviours are equally subject to developmental trends?. Again, to test for the age factor, the Friedman's Two-Way Analysis of Variance was used on the scores from the same six breast-fed infants at WEEKS 1,4,8,16 and 20 and the same six bottle fed infants at WEEKS 1,4,8,12,20 and 24. (See Table 5.7, page 114).

In the breast-feeding sub-sample , CHANGES IN SUCK PATTERN ($xr^2 = 17.37$, df = 4, $p < .01$), EYES CLOSING ($xr^2 = 14.9$, df = 4, $p < .01$) and STOPS SUCKING ($xr^2 = 16.85$, df = 4, $p < .01$) all showed a significant age trend. From Fig. 5.1 it looks as though the age factor in CHANGES IN SUCK PATTERN reflects a drop in frequency at WEEK 16. EYES CLOSING (see Fig. 5.3) shows a similar trend although the change in frequency appears to occur four weeks earlier at WEEK 12. STOPS SUCKING (see Fig. 5.2), on the other hand, shows a trend which suggests that rather than the behaviour simply reducing in frequency, it seems to drop out. Again the age change

FIG. 5.1 Mean frequency changes in **sucking pattern**

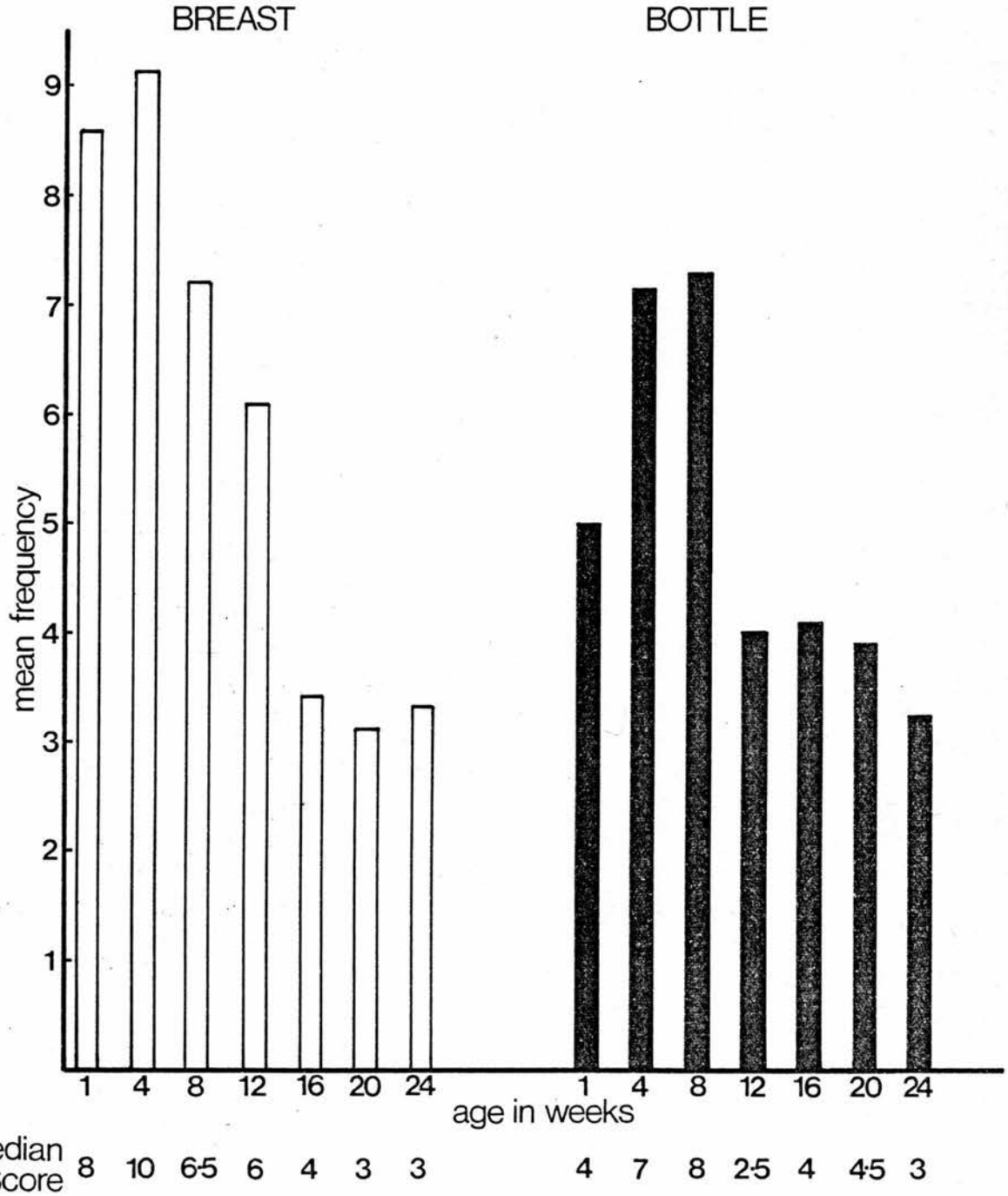
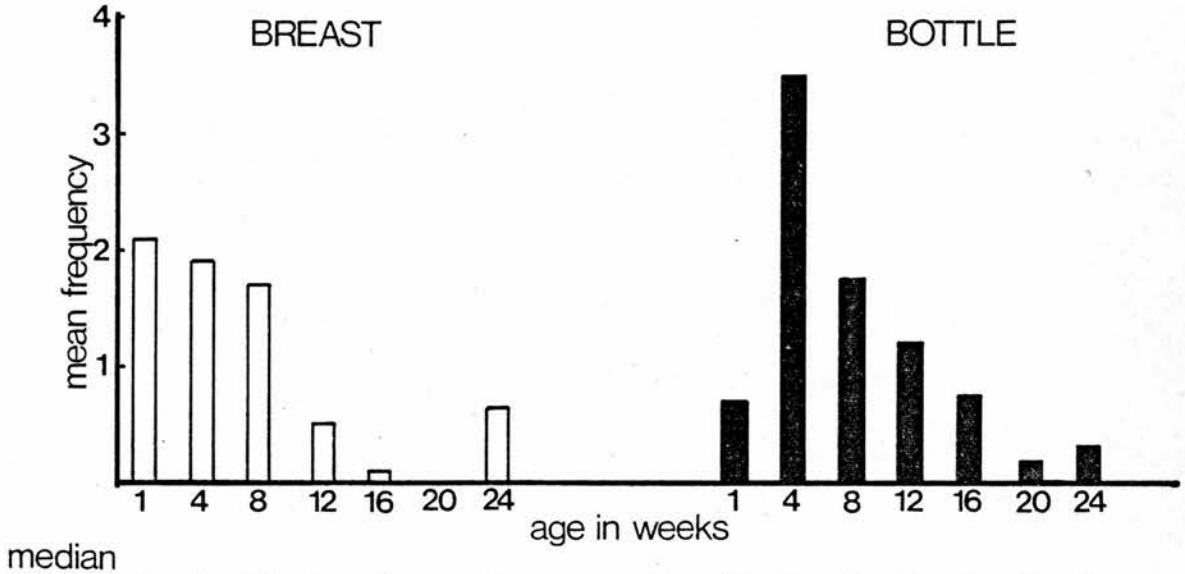
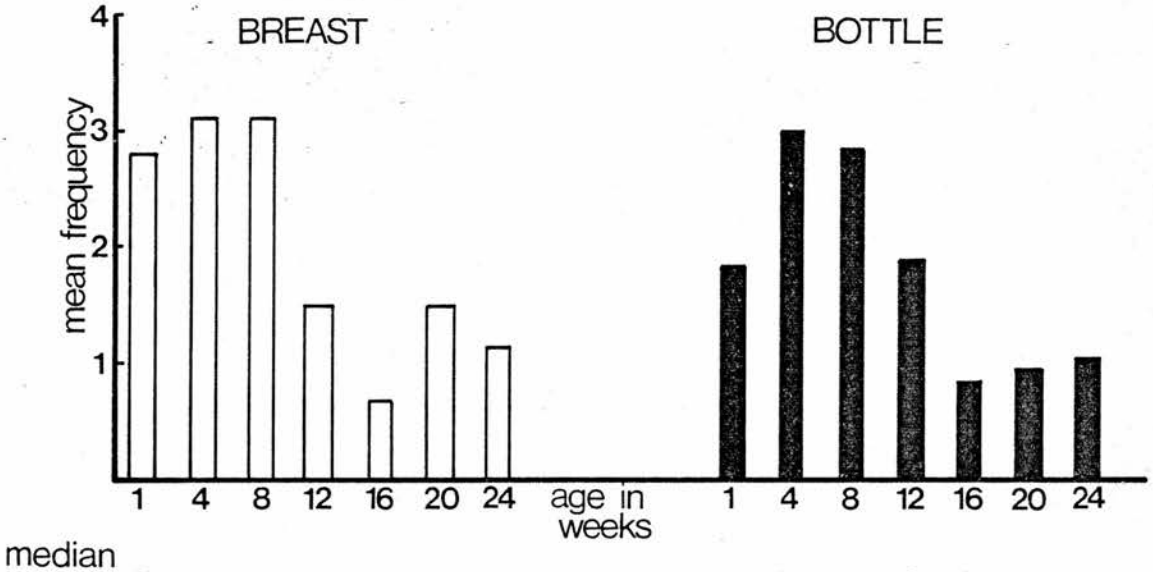


FIG 5.2 Mean frequency **stops sucking**



median score	1	2	1·5	0	0	-	1		0	2	2	1	1	0	0

FIG 5.3 Mean frequency of **eyes closing**



median score	3	2	3	2	1	2	1		1	2·5	2	2	0	1	·5

FIG 5.4 Mean frequency of **refuses to open**

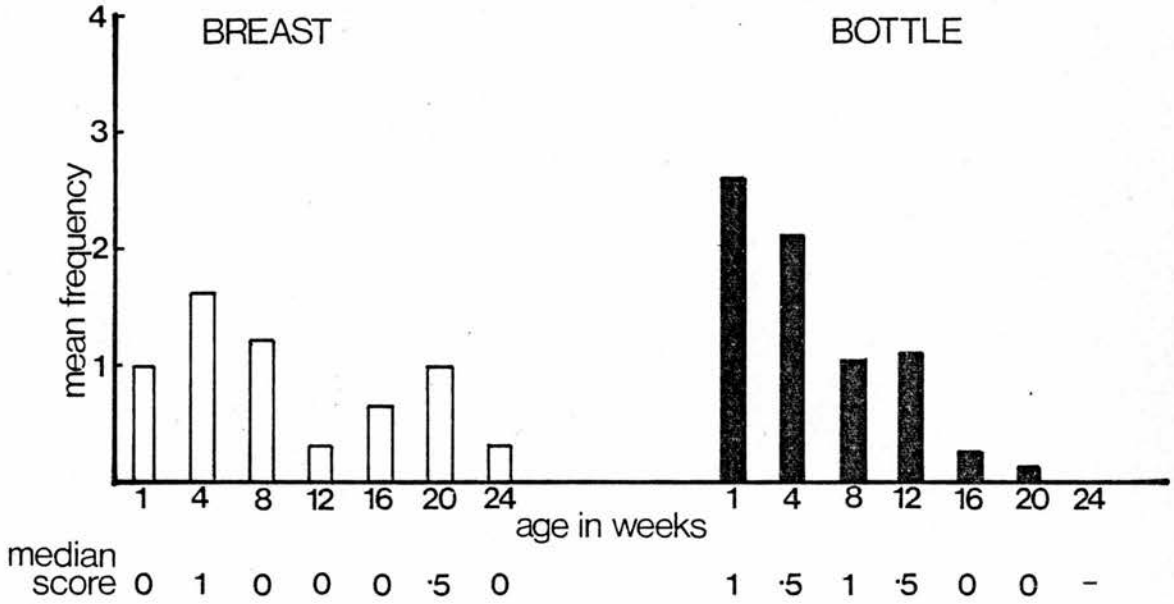


FIG 5.5a Mean frequency of **comes off breast**

FIG 5.5b **spits teat out**

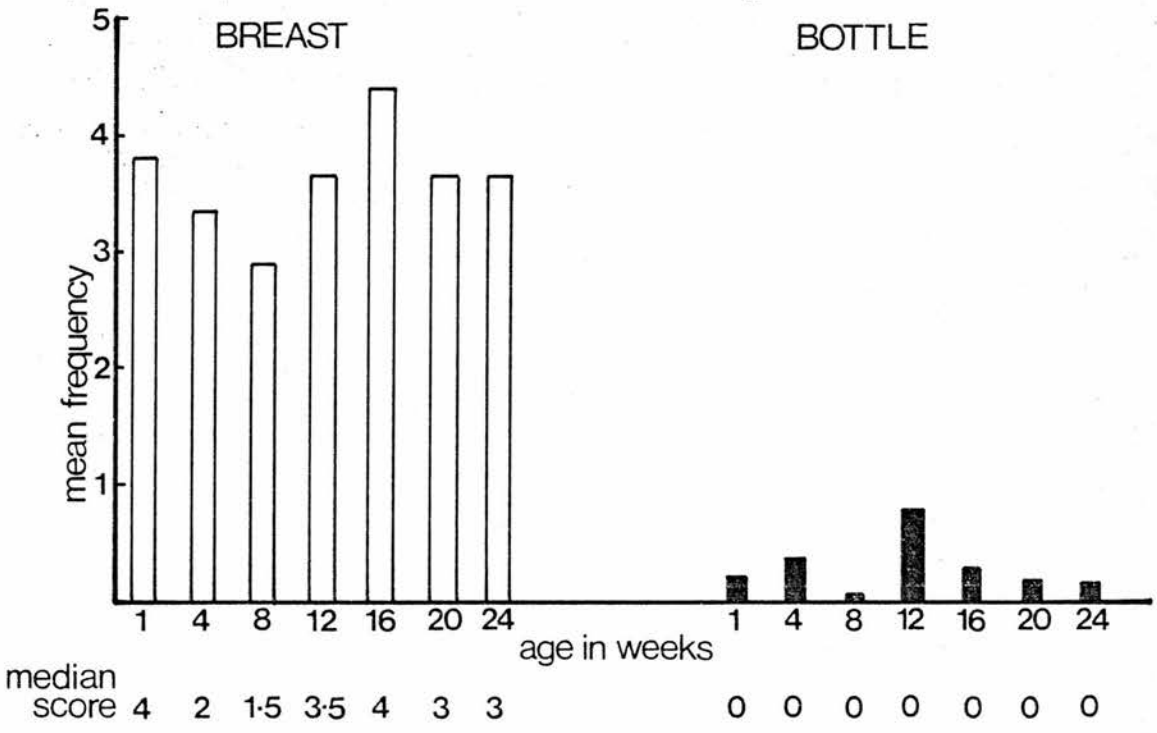


FIG 5.6 Mean frequency of **oral behaviours**

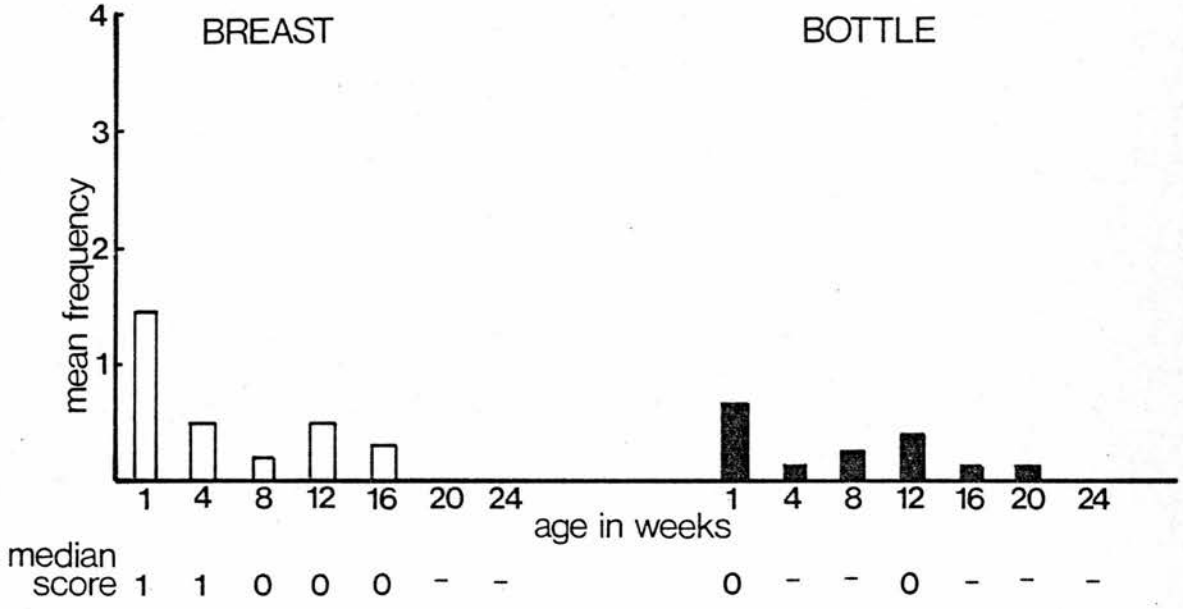


FIG 5.7 Mean frequency of **cry/protest**

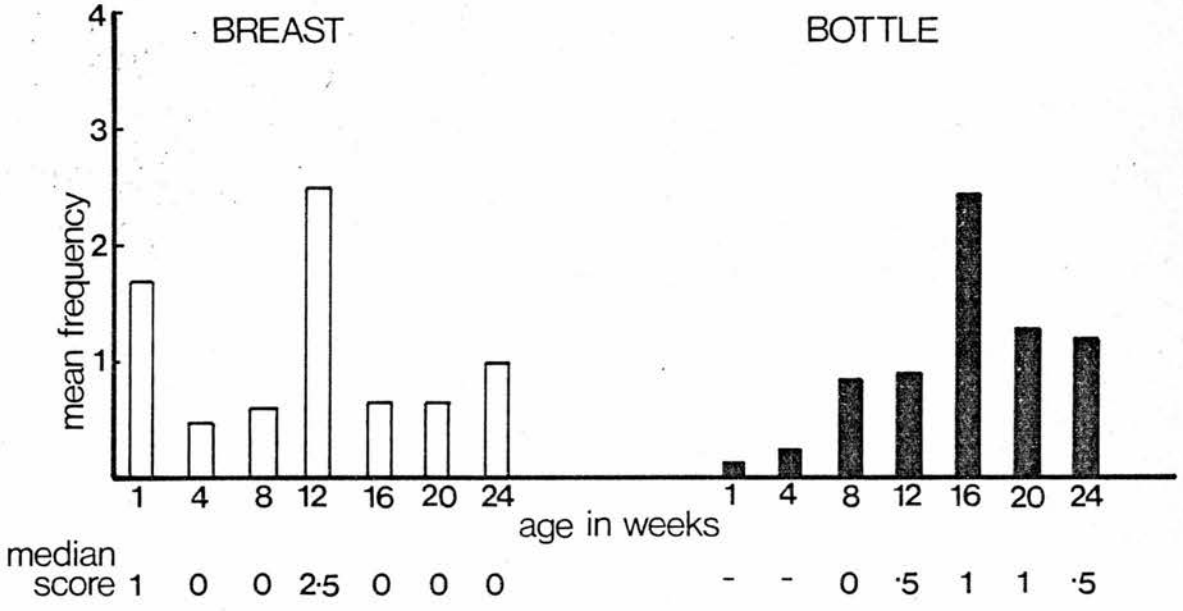


FIG 5.8 Mean frequency of **choke**

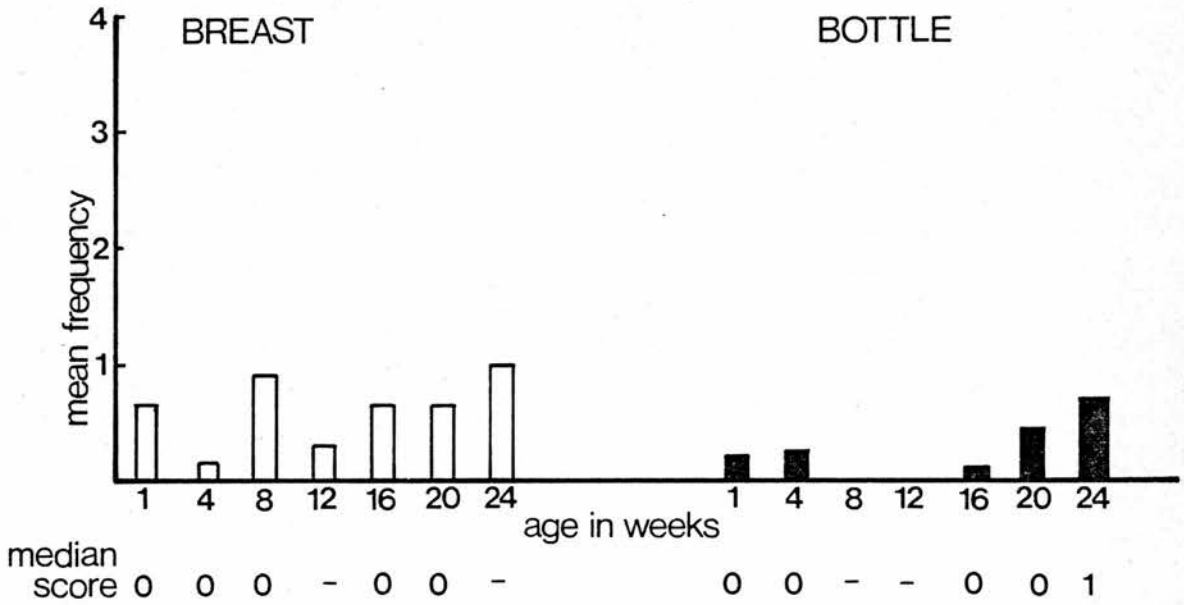


FIG 5.9 Mean frequency of **burps**

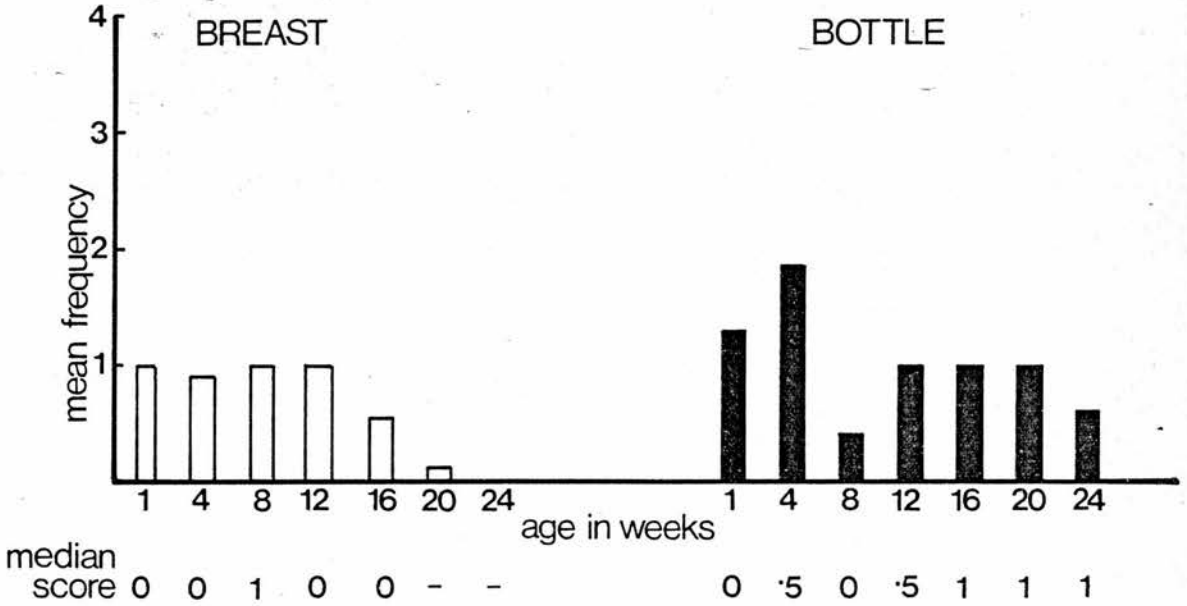


TABLE 5.7

Infant Behaviours analysed independently by AGE and TECHNIQUE.

TYPE OF BEHAVIOUR	ANALYSIS OF VARIANCE Breast(1)	Bottle (2)	INDIVIDUAL AGE DIFFERENCES.Br./Bt.
Changes in Suck Pattern	$p < .01$	NS	WEEK 1 U = 20.5 p = .025 *
Eyes Closing	$p < .01$	NS	NS
Spits teat out	NR	NR	- (3)
Stops Sucking	$p < .01$	$p < .01$	WEEK 1 U = 27 p = .05 *
Comes Off	NS	NR	- (3)
Refuses to open	NS	NS	NS
Oral Behaviours	NR	NR	- (3)
Cry/Protest	NS	NS	WEEK 1 U = 17 p = .01*
Choke	NR	NS	- (3)
Burps	NS	NS	NS

(1) Breast feeders: Analysis of Variance using age categories weeks 1,4,8,16,20, and six infants who were scored at each age category. (Friedman Two-Way Analysis of Variance).

(2) Bottle feeders: Analysis of Variance using age categories weeks, 1,4,8,12,20,24 and six infants who were scored at each age category. (Friedman Two-Way Analysis of Variance).

* Mann-Whitney - U Test, One-Tailed Test.

3. Irrelevant Comparison.

occurs in the middle weeks, at WEEK 12.

In the bottle feeding sub-sample, the only behaviour showing a statistically significant trend is STOPS SUCKING ($xr^2 = 15.82$, df = 5, $p < .01$) and the form in which the trend takes is essentially the same as that shown in the breast feeders except that it seems to drop out rather later at WEEK 20 (see Fig. 5.2). Equally, although neither CHANGES IN SUCK PATTERN ($xr^2 = 7.9$, df = 5, $p < .2$), nor EYES CLOSING ($xr^2 = 6.6$, df = 5, $p < .3$) show a significant age effect, the trend also appears to be similar to that shown in the breast feeding infants. A possible explanation for the absence of a significant age trend in the bottle feeders was thought to be a result of the lowered frequencies of both the latter behaviours at WEEK 1. But even when these frequencies are removed from the analysis, the trend does not reach significance.

The remaining behaviours show no significant age effects, whatever the technique. CHOKE (see Fig. 5.8) and BURPS (see Fig. 5.9) are too infrequent for any effect to be captured, whilst SPITS THE TEAT OUT and ORAL BEHAVIOURS are so infrequent that they were not even worthy of analysis. REFUSAL TO OPEN, on the other hand, produced a surprising lack of an age trend in bottle feeders, in contrast to the obvious lack of a trend in breast feeders (see Fig. 5.4). What it may reflect is a variation in individual frequencies which are idiosyncratic and a response to some age independent factor. Similarly, CRY/PROTEST (see Fig. 5.7), shows a variation in both frequencies which is not solely related to infant actions. Some factor , other than a general developmental trend, may thus also be involved. COMES OFF, the remaining behaviour to be discussed, is that showing the clearest trend. It seems to occur with similar frequency whatever the age of the breast feeding infant, (see Fig. 5.5a).

Thus, there seems to be three possible factors emerging from this analysis. Developmental trends are tentatively suggested in some of the behaviours but they are more apparent in the breast feeding infant and occur earlier. (WEEKS 12/16 as opposed to WEEK 20 in the bottle feeding infants), COMES OFF is the behaviour showing the most consistently high frequency throughout the six months, and at WEEK 1 the bottle feeding infants appear to show rather lowered frequencies in several of the behaviours studied in contrast to the breast feeding infants. These produce differences which are significant in CHANGES IN SUCK PATTERN ($n_2 = 11$; $U = 20.5$; $p = .025$), STOPS SUCKING ($n_2 = 11$; $U = 27$; $p = .05$) and CRY/PROTEST ($n_2 = 11$, $U = 17$; $p = .01$), predictions that come from the earlier finding of the overall difference in frequency of behaviours at this age. (See Table 5.2). It also looks as though these differences are possibly specifically related to factors occurring in WEEK 1. At WEEK 20, where there is a similar significant difference in the overall frequency of behaviours between the two groups (see Table 5.2), there are no comparable differences between the commonly occurring behaviours. Rather, the frequency of COMES OFF in the breast feeding infants appears to be the factor contributing to this later difference. When it is removed from the total of the behavioural frequencies of the breast feeders, the difference between the two groups is no longer significant ($n_2 = 6$; $U = 24$, NS).

Turning next to the place in the feed where the behaviours occur, analysis further explores the potential signal capacity of the various behaviours. The results are presented graphically in Figs 5.10 to 5.16 (see pages 117 - 120), illustrating the percentage of the total frequency with which each behaviour was observed to

FIG 5.10 Distribution of **changes in suck pattern** throughout feed

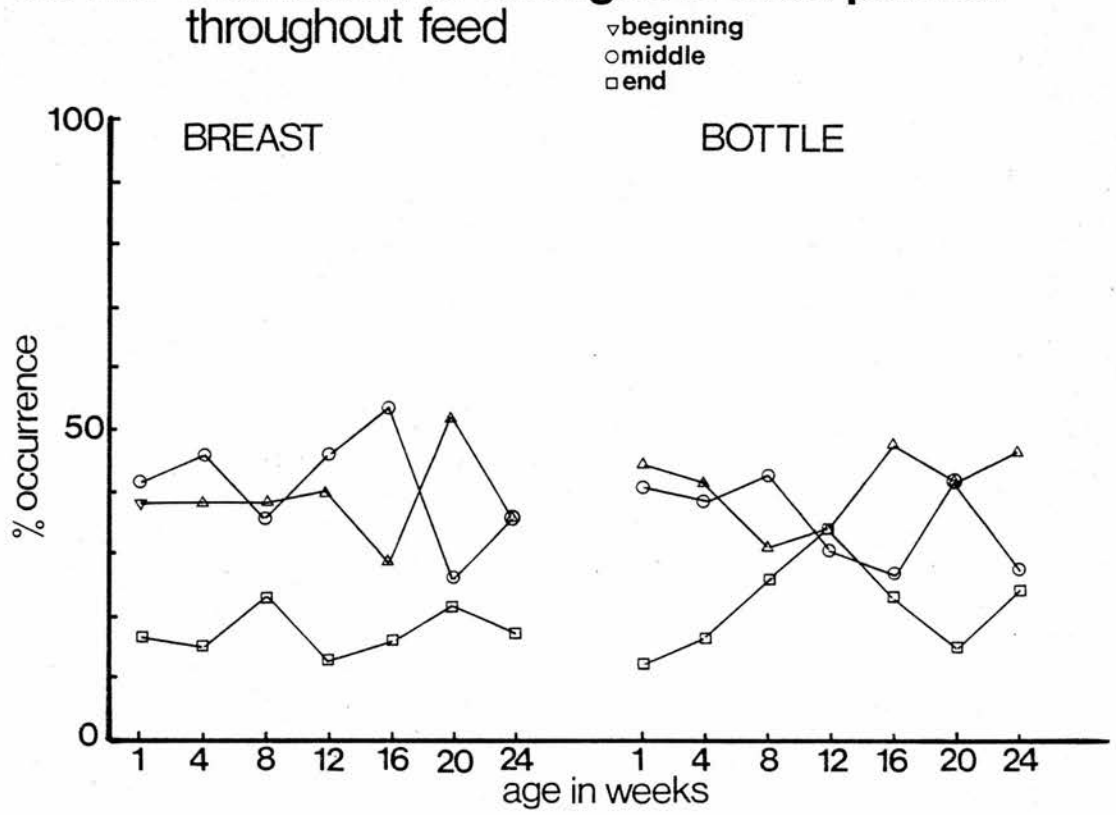


FIG 5.11 Distribution of **stops sucking** throughout feed

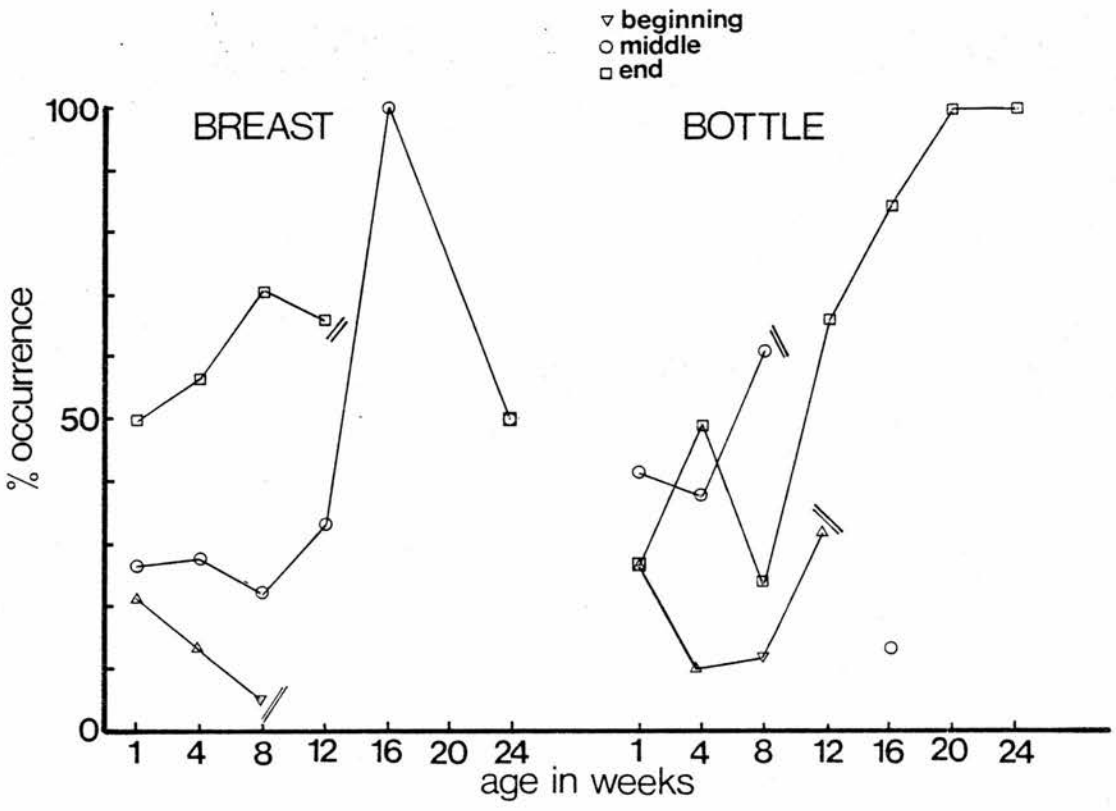


FIG 5.12 Distribution of **eyes closing** throughout feed

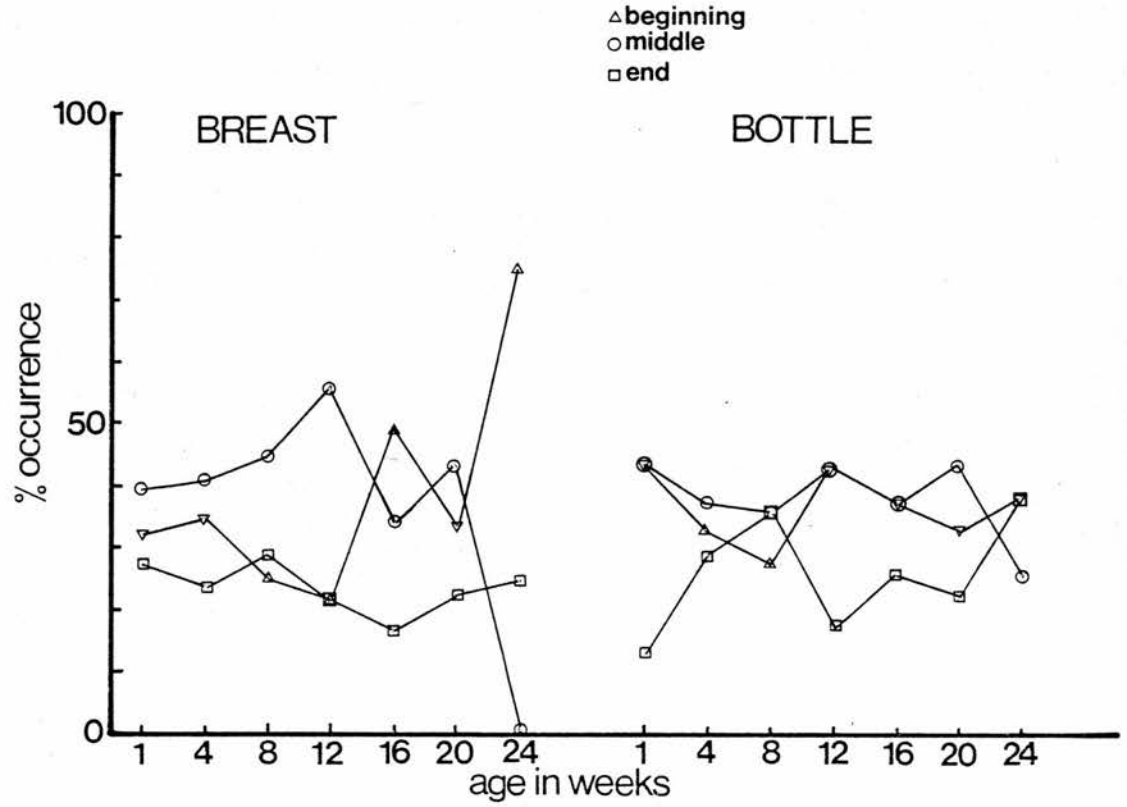


FIG 5.13 Distribution of **refuses to open** throughout feed

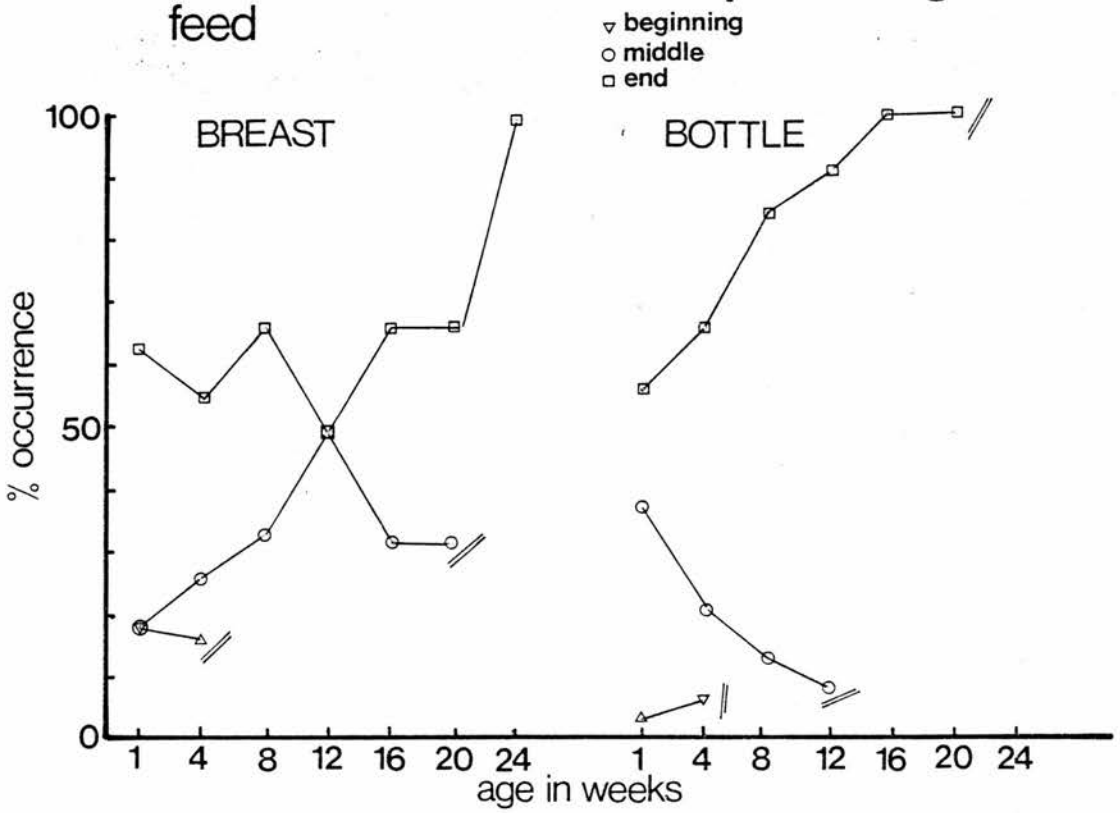


FIG 5.14a Distribution of **comes off** in breast feeders throughout feed (b) **spits teat out** in bottle feeders

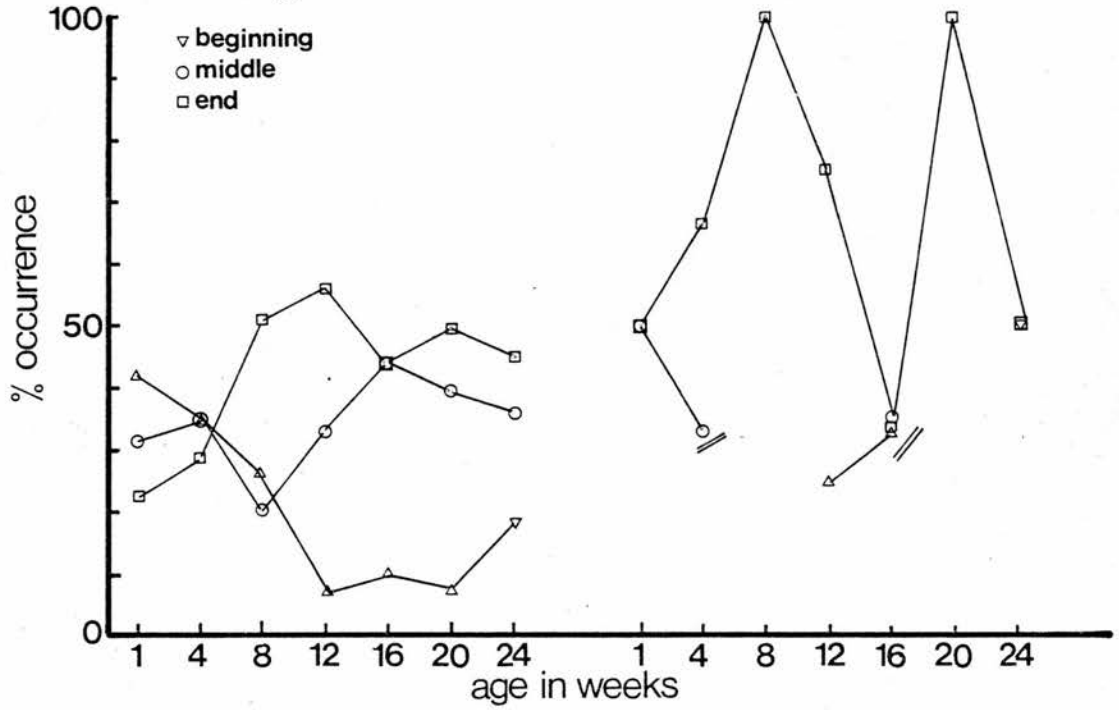


FIG 5.15 Distribution of **cry/protest** throughout feed

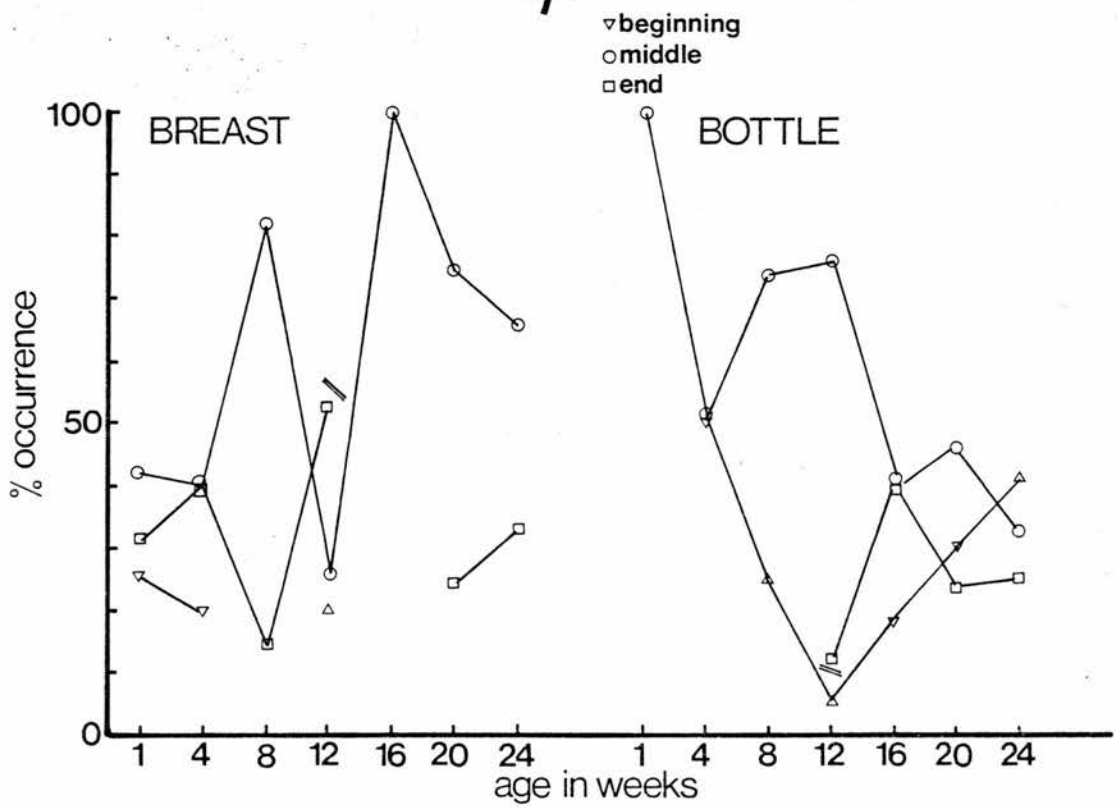
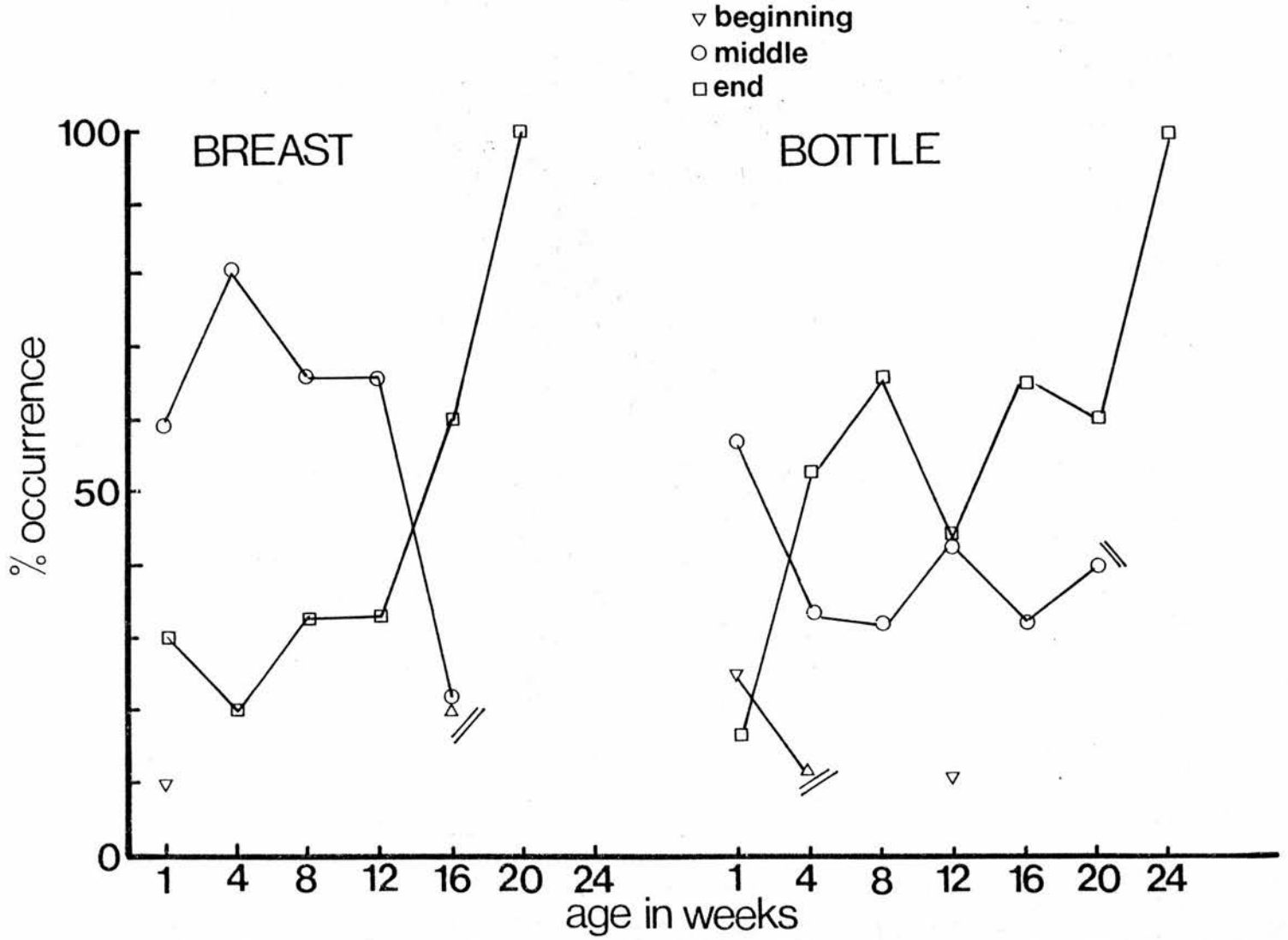


FIG 5.16 Distribution of **burps** throughout feed



occur at the beginning, middle or end of the feed.

The behaviours appear to fall into three general types of distribution; behaviours occurring predominantly in the beginning/middle period, behaviours occurring most frequently at the end of the feed and behaviours which appear to show no consistent relationship with place in the feed.

BEGINNING/MIDDLE PERIOD

The behaviour which is most likely to occur in the beginning/middle period of the feed appears to be CHANGES IN SUCK PATTERN (see Fig. 5.10). In the breast feeding infants, at no stage in the six month period studied did it occur more frequently at the end. During the first 12 weeks, it seemed to occur with similar frequency at the beginning and middle period, reaching a significant distribution at WEEK 4 ($p < .01$) and WEEK 12 ($p < .05$). At WEEK 16, it occurred most frequently in the middle period ($p < .006$); at WEEK 20 most frequently at the beginning and at WEEK 24 with equal frequency at beginning and middle.(See Table 5.8a for results of the Statistical Analysis).

In the bottle feeding infants, whilst the trend is less clear cut in the middle age group, it nevertheless, appears to follow the distribution found in the breast feeders. At WEEKS 1,4 and 20, CHANGES IN SUCK PATTERN occurs most frequently in the beginning and middle period, the trend reaching significance at WEEK 1 ($p < .003$) and WEEK 20 ($p < .05$); at WEEK 16 and WEEK 24 ($p < .05$) most frequently at the beginning; at WEEK 8 most frequently in the middle part of the feed; and at WEEK 12, with equal frequency at any change in the feed. (See Table 5.8b and Fig. 5.10).

END PERIOD

The behaviours which appear to show a trend such that they occur most consistently at the end of the feed are STOPS SUCKING

TABLE 5.8(a)(b)

STATISTICAL ANALYSIS* of DISTRIBUTION of INFANT BEHAVIOURS ACCORDING to PLACE in the FEED, by AGE.

BREAST FEEDING INFANTS (a)

INFANT BEHAVIOURS	1	4	8	12	16	20	24
Changes in Sucking Pattern	NS	$<.01$	NS	$<.05$	$<.006$	NS	NS
Stops Sucking	NS	$<.001$	NS	TOO FEW	MID ONLY		
Eyes Closing	NS	NS	NS	NS	NS	NS	NS
Refuses to open Mouth	NS	$<.001$	NS	EQUAL	NS	TOO FEW	END ONLY
Comes Off	NS	NS	NS	NS	$<.016$	NS	NS
Cry/Protest	NS	NS	NS	NS	MID ONLY	TOO FEW FOR ANALYSIS	
Burps	NS	NS	NS	$<.004$	NS	END ONLY	

BOTTLE FEEDING INFANTS (b)

Changes in Sucking Pattern	$<.003$	NS	NS	NS	NS	$<.05$	$<.05$
Stops Sucking	NS	NS	NS	NS	$<.039$	END ONLY	END ONLY
Eyes Closing	NS	NS	NS	NS	NS	NS	NS
Refuses to open Mouth	NS	NS	NS	NS	NS	END ONLY	END ONLY
Spits teat out		TOO INFREQUENT FOR ANALYSIS					
Cry/Protest	MID ONLY	EUAL	NS	NS	NS	NS	NS
Burps	NS	NS	NS	NS	NS	NS	END ONLY

* Friedman Two-Way Analysis of Variance (Siegal, 1956)

(Fig. 5.11), REFUSES TO OPEN (Fig. 5.13) and SPITS THE TEAT OUT (Fig. 5.14b). In the breast feeding infants, STOPS SUCKING is always most frequently found at the end of the feed until WEEK 16, showing a significant distribution at WEEK 4 ($p = .001$). REFUSES TO OPEN is also most frequently found at the end of the feed, except at WEEK 12, but this trend continues until WEEK 24 where it is the only place of occurrence, and shows a significant distribution at WEEK 4 ($p = .001$).

In bottle feeding infants all three of the above behaviours occur, although SPITS THE TEAT OUT is something very few infants do. STOPS SUCKING (see Fig. 5.11) does not appear to establish its place at the end of the feed until WEEK 12. But by WEEK 16 this distribution is significant ($p = .039$) and subsequently is the only place of occurrence. REFUSAL TO OPEN (see Fig. 5.13), on the other hand, always appears to occur most frequently at the end of the feed, thus showing a similar trend to that found in the breast feeding infact. SPITS THE TEAT OUT (see Fig. 5.14b) whilst it appears to occur with equal frequency in the middle and end at WEEK 1, at the beginning and end at WEEK 24, and at the beginning/middle/end at WEEK 16, no statistical analysis was made because the frequency of occurrence was too small. There is, however, a suggestion from the results that it is the least reliable behaviour in this category in terms of where it is likely to occur in the feed.

NO CONSISTENT PERIOD IN THE FEED.

Behaviours which appear to have no consistent trend in terms of where they occur in the feed are EYES CLOSING (see Fig. 5.12), CRY/PROTEST (see Fig. 5.15)and COMES OFF (see Fig. 5.14).

Even though EYES CLOSING is a behaviour which occurs in more than 80% of all breast fed infants and in more than 66% of bottle fed infants at most ages, the p values calculated for both groups

suggest that there does not appear to be a particular place in the feed where it appears. (See Table 5.8 (a)(b), page 122).

CRY/PROTEST shows a similar picture of low p values in the bottle fed infants after WEEK 16, and in the breast fed infants at WEEKS 1,4 and 12. At the other age periods there is a tendency for the behaviour to occur more frequently in the middle period. In the breast feeders this is most apparent at WEEK 8 and then from WEEK 16. Whilst in the bottle feeders the trend is most apparent at WEEKS 1, 8 and 12.

COMES OFF also appears to show shifts in the trend of its occurrence. At WEEKS 1,4 and 24, the breast fed infant may COME OFF at any period in the feed, but at WEEK 8 this now appears to occur predominantly in the end period. This trend remains apparent until WEEK 16 when it changes to a pattern of a similar frequency at the middle and end period, reaching a significant distribution at this age (p=.016).

ORAL BEHAVIOURS (see Fig. 5.6), CHOKE (see Fig. 5.8) and BURPS (see Fig. 5.9 and Fig. 5.16) are the three remaining behaviours not discussed. They are all behaviours which, because of certain characteristics, require particular caution when interpreting their potential value as signals. ORAL BEHAVIOURS and CHOKE occur very infrequently and, therefore, cannot be analysed with any confidence for their place of occurrence. BURPS does not share this handicap. However, because it is a behaviour related more to what goes on during breaks in the feed, to make any interpretation of its place in the feed seemed inappropriate.

What then can be said about the potential capacity of the infant to signal motivational state?. A factor which could have accounted for the distribution of the behaviours found, was the method by which the feed had been divided up into the three time periods. The

middle period was in fact double the length of the beginning and the end period. Had the behaviours occurred with twice the frequency (or significantly more frequently) in this period then no further interpretation of the results could have been offered. However, this distribution occurred rarely and, therefore, is not a confounding factor. Also, before commenting on the results, it must be said that any conclusions drawn from the analysis can only be tentative because of the small number of infants observed. This is particularly true of the breast feeders in the later months.

Various changes in the sucking pattern have been suggested as indicators of hunger, satiety and a response to taste. Certainly CHANGES IN SUCK PATTERN were observed throughout the six month period of milk feeding whatever the technique used. But they appeared to occur more frequently at the beginning and middle period of the feed. As a description of behaviour it is only a very crude measure, even so, it is a signal which seems least likely to indicate satiety. It would seem to be more to do with getting the food and responding to its taste. Had the various forms of change been more thoroughly examined, then a different picture could have emerged. In this study, however, it is STOPS SUCKING (Fig. 5.12), REFUSES TO OPEN (Fig. 5.14) and the infrequently occurring behaviour in the bottle feeder, SPITS THE TEAT OUT (Fig. 5.15) which are the behaviours most unambiguously appearing to have the potential to signal satiety, since they were the behaviours occurring most consistently at the end of the feed. The possible exception to this tentative conclusion is STOPS SUCKING in the bottle feeder which does not in fact establish its place clearly at the end of the feed until WEEK 12. But what all these three behaviours do share is the tendency to drop out after WEEK 12 to WEEK 16. If, therefore, the only potentially reliable

satiety signals are those which occur consistently at the end of the feed, then one is left with the surprising fact that after WEEK 16, satiety is no longer a state that is signalled. Other behaviours which occur at the end of the feed, particularly in the older age groups are COMES OFF (see Fig. 5.15), CRY/PROTEST (see Fig. 5.17) and EYES CLOSING (see Fig. 5.13), so that they also have the potential to act as satiety signals. But the problem with their interpretation is that they also occur at other periods in the feed. They must, therefore, either be multipurpose or change their meaning in the course of development if they take over this function. To examine for this possibility and to explore further the potential role of STOPS SUCKING and REFUSAL TO OPEN to act as satiety signals, the sequence in which behaviours occur was looked at, focussing on the immediately preceding and following behaviours. For any behaviour to have the potential to be a signal of satiety, the assumption was that it must be followed by no further feeding.

The first behaviour looked at was STOPS SUCKING. In the breast feeding infants it is most frequently preceded by CHANGES IN SUCK PATTERN (40% of all behaviours throughout the 12 WEEKS), or by COMES OFF after WEEK 1. The most frequent behaviour which follows it is COMES OFF at WEEKS 1 and 4 (50% of all behaviours) and from WEEK 8 by a preponderance of behaviours which reflect a stop in feeding (STOPS SUCKING, COMES OFF, NO FURTHER SUCKS and REFUSES TO OPEN). (See Table 5.9). In the bottle feeding infants again, CHANGES IN SUCK PATTERN is the largest individually occurring preceding behaviour, with STOPS SUCKING the second most frequent preceding behaviour. The behaviours following STOPS SUCKING in the bottle feeding infants, on the other hand, show very little obvious pattern. In contrast to those found in the breast feeding infants they were more varied,

TABLE 5.9

PERCENTAGE OF BEHAVIOURS PRECEDING and FOLLOWING STOPS SUCKING in BREAST FEEDING INFANTS.

AGE IN WEEKS	1	4	8	12*	16*	20*	24*
PRECEDES Changes in sk. Patt.	50.00	40.91	47.05				
Stops sucking	22.73	18.18	29.41				
Spits Teat out	Nil	Nil	Nil				
Comes off	9.09	27.27	17.65				
Refuses to Open	4.55	4.55	Nil				
Eyes Closing	4.55	4.55	5.88				
Cry/Protest	9.09	Nil	Nil				
Oral Behaviours	Nil	4.55	Nil				
Choke	Nil	Nil	Nil				
Burps	Nil	Nil	Nil				
No further sucks	Nil	Nil	Nil				
FOLLOWS Changes in sk. Patt.	9.09	18.19	17.64				
Stops sucking	22.73	18.18	29.41				
Spits Teat out	Nil	Nil	Nil				
Comes off	50.00	50.00	29.41				
Refuses to Open	Nil	Nil	5.88				
Eyes Closing	Nil	Nil	Nil				
Cry/Protest	4.55	Nil	Nil				
Oral Behaviours	Nil	Nil	Nil				
Choke	Nil	Nil	Nil				
Burps	Nil	Nil	Nil				
No further sucks	13.64	13.64	17.65				
Total Behaviours	22	22	17				

* (WEEKS 12,16,20, 24: Too Few Behaviours for Analysis)

particularly at WEEKS 8 and 12. (See Table 5.10). Nor can it be suggested, with any certainty, that a stop in feeding is the most likely outcome until WEEK 12. In the earlier weeks, CHANGES IN SUCK PATTERN; EYES CLOSING and CRY/PROTEST make up a considerable percentage of the total behaviours occurring.

The proposal, therefore, that STOPS SUCKING is a potential satiety signal, is given more tentative support in the breast feeding infant than it is in the bottle feeding infant. But even in the breast feeding infant, the degree to which this support stands up depends further on the outcome of COMES OFF, particularly at WEEKS 1 & 4, when it makes up fifty per cent of the following behaviours. So, before drawing any tentative conclusions, one first needs to know more specifically when in the feed COMES OFF and STOPS SUCKING occur in sequence.

Table 5.11 shows that COMES OFF tends to precede STOPS SUCKING either at the beginning or the end of the feed but follows STOP SUCKING most frequently at the end of the feed. This may seem illogical, but, through limitations in the scoring method, the infant may COME OFF, be put back on, start to suck and then STOP SUCKING. From a rather crude assessment of all the behaviours following COMES OFF, REFUSAL TO OPEN, NO FURTHER SUCKS, STOPS SUCKING and COMES OFF together form more than 70% of all the likely consequent behaviours at WEEKS 1,4 & 8. Only at WEEK 8, is it unlikely by chance that STOPS SUCKING followed by COMES OFF will not lead to no further sucking. So that it does seem that in the breast feeding infant, there is a suggestion that STOPS SUCKING is associated with satiety. But, as a potential signal, it tends not to occur on its own. Rather it seems to occur in sequence with COMES OFF and then REFUSAL TO OPEN.

Turning now to REFUSAL TO OPEN, in the breast feeding infant, the behaviours most frequently preceding it are COMES OFF or a

TABLE 5.10

PERCENTAGE of BEHAVIOURS PRECEDING and FOLLOWING STOPS SUCKING in BOTTLE FEEDING INFANTS.

AGE IN WEEKS	1	4	8	12	16	20*	24*
PRECEDES Changes in sk. Patt.	57.15	29.00	75.00	27.27	40.00		
Stops sucking	28.57	32.00	12.50	27.27	Nil		
Spits teat out	Nil	Nil	Nil	9.09	20.00		
Comes off	Nil	Nil	Nil	Nil	Nil		
Refuses to Open	Nil	11.00	Nil	9.09	20.00		
Eyes Closing	14.29	14.00	Nil	18.18	Nil		
Cry/Protest	Nil	Nil	12.50	Nil	20.00		
Oral Behaviours	Nil	Nil	Nil	Nil	Nil		
Burps	Nil	14.00	Nil	Nil	Nil		
No further sucks	Nil	Nil	Nil	9.09	Nil		
FOLLOWS Changes in sk. Patt.	14.29	18.00	25.00	27.27	Nil		
Stops sucking	28.57	36.00	12.50	27.27	Nil		
Spits teat out	Nil	6.00	6.25	18.18	Nil		
Comes off	Nil	Nil	Nil	Nil	Nil		
Refuses to Open	Nil	4.00	12.50	9.09	20.00		
Eyes Closing	28.57	18.00	Nil	Nil	Nil		
Cry/Protest	Nil	Nil	18.75	9.09	Nil		
Oral Behaviours	Nil	4.00	Nil	Nil	Nil		
Choke	Nil	Nil	Nil	Nil	Nil		
Burps	Nil	4.00	Nil	Nil	Nil		
No further sucks	28.57	10.00	25.00	9.09	80.00		
Total Behaviours	7	28	16	12	6		

* (Weeks 20, 24: Too Few Behaviours for Analysis)

TABLE 5.11

Breast Feeders: COMES OFF in SEQUENCE with STOPS SUCKING by AGE and PLACE in the FEED.

COMES OFF	WEEK 1			WEEK 4			WEEK 8			WEEK 12		
	Beg.	Mid.	End	Beg.	Mid.	End	Beg.	Mid.	End	Beg.	Mid.	End
Precedes	1	0	1	2	1	3	0	0	3	0	0	0
Follows	2	2	6	2	1	7	0	1	4	0	0	1

further REFUSAL TO OPEN. The following behaviours, are, however, less easy to describe concisely. Although REFUSAL TO OPEN is most frequently in sequence with itself, CHANGES IN SUCK PATTERN can also occur, suggesting that on occasions the feed is not terminated immediately. (See Table 5.12). A similar trend is apparent in the bottle feeders. REFUSAL TO OPEN tends to precede and follow itself most frequently as it forms the highest percentage of behaviours occurring in both the preceding and following analysis. But CHANGES IN SUCK PATTERN can also follow REFUSAL TO OPEN, although it is perhaps slightly less obvious in the bottle feeding infant. (See Table 5.13). A picture thus emerges of REFUSAL TO OPEN forming a sequence with COMES OFF in the breast feeding infant and a sequence with itself in the bottle feeding infant. Tentatively, therefore, this sequence analysis offers some support for the view that as a behaviour it has the potential to act as a satiety signal. For not only does it occur most frequently at the end of the feed, but it also tends to be associated more frequently with an outcome of no further sucking than further feeding. But perhaps rather surprisingly, given the rather clearer picture suggested from the analysis of occurrence by place in the feed, it can, on occasions, also be followed by a period of sucking.

To test the hypothesis that COMES OFF changes its meaning some support comes for this proposal in the finding that two patterns of

TABLE 5.12

PERCENTAGE of BEHAVIOURS PRECEDING and FOLLOWING REFUSES TO OPEN in BREAST FEEDING INFANTS.

AGE IN WEEKS	1	4	8	12*	16	20	24*
PRECEDES Changes in sk. Patt.	Nil	5.56	8.33		Nil	Nil	
Stops sucking	Nil	Nil	8.33		Nil	Nil	
Spits teat out	Nil	Nil	Nil		Nil	Nil	
Comes off	63.64	61.10	25.00		100.00	66.66	
Refuses to Open	36.36	27.78	41.67		Nil	33.33	
Eyes Closing	Nil	5.56	16.67		Nil	Nil	
Cry/Protest	Nil	Nil	Nil		Nil	Nil	
Oral Behaviours	Nil	Nil	Nil		Nil	Nil	
Choke	Nil	Nil	Nil		Nil	Nil	
No further sucks	Nil	Nil	Nil		Nil	Nil	
FOLLOWS Changes in sk. Patt.	18.18	33.34	16.66		33.34	50.00	
Stops sucking	9.09	5.56	Nil		Nil	Nil	
Spits teat out	Nil	Nil	Nil		Nil	Nil	
Comes off	9.09	11.11	8.33		16.67	Nil	
Refuses to Open	36.36	27.78	41.67		Nil	25.00	
Eyes Closing	Nil	5.56	8.33		Nil	Nil	
Cry/Protest	Nil	Nil	Nil		Nil	Nil	
Oral Behaviours	Nil	Nil	Nil		Nil	Nil	
Choke	Nil	Nil	Nil		Nil	Nil	
Burps	Nil	Nil	Nil		Nil	Nil	
No further sucks	27.27	16.67	25.00		50.00	25.00	
Total Behaviours	16	18	12		6	6	

* (Weeks 12 and 24: Too Few Behaviours for Analysis)

TABLE 5.13

PERCENTAGE of BEHAVIOURS PRECEDING and FOLLOWING REFUSES TO OPEN in BOTTLE FEEDING INFANTS.

AGE IN WEEKS	1	4	8	12	16*	20*	24*
PRECEDES Changes in sk. Patt.	8.70	3.88	22.22	18.18			
Stops sucking	4.35	17.65	22.22	9.09			
Spits teat out	4.35	11.76	Nil	27.27			
Comes off	Nil	Nil	Nil	Nil			
Refuses to Open	56.52	41.18	22.22	36.36			
Eyes Closing	17.39	25.53	33.33	9.09			
Cry/Protest	4.35	Nil	Nil	Nil			
Oral Behaviours	4.35	Nil	Nil	Nil			
Choke	Nil	Nil	Nil	Nil			
Burps	Nil	Nil	Nil	Nil			
No further sucks	Nil	Nil	Nil	Nil			
FOLLOWS Changes in sk. Patt.	8.70	23.53	22.22	18.18			
Stops sucking	Nil	23.53	Nil	9.09			
Spits teat out	8.70	Nil	11.11	18.18			
Comes off	Nil	Nil	Nil	Nil			
Refuses to Open	56.52	41.18	22.22	36.36			
Eyes Closing	4.35	Nil	11.11	Nil			
Cry/Protest	4.35	Nil	Nil	Nil			
Oral Behaviours	Nil	Nil	Nil	Nil			
Choke	Nil	Nil	Nil	Nil			
Burps	Nil	Nil	Nil	Nil			
No further sucks	17.39	11.76	33.33	18.18			
Total Behaviours	22	17	9	11			

* (Weeks 16, 20 and 24: Too Few for Analysis)

Preceding and following behaviours can be seen. From Table 5.14 it is evident that in the preceding behaviours, in WEEKS 1, 4 and 8, CHANGES IN SUCK PATTERN, STOPS SUCKING or a previous COMES OFF are the most frequent behaviours, whereas from WEEK 12, the predominant behaviours become PUTS SELF ON and CHANGES IN SUCK PATTERN. Similar shifts in behaviours making up the following behaviours are also evident and interestingly, in the same age groups. In WEEKS 1,4 and 8, although REFUSES TO OPEN, CHANGES IN SUCK PATTERN and a further COMES OFF are frequently occurring consequent behaviours, unlike the pattern of the preceding behaviours at these earlier age groups, they reflect a rather more random collection of behaviours as others also occur at a moderate frequency from time to time. It almost seems that the infant does not know what to do. However, by WEEK 12 this pattern changes quite markedly. Now there appears to be more obvious order, with the most frequent consequent action PUTS SELF ON. REFUSES TO OPEN, NO FURTHER SUCKS and further COMES OFF together contributing considerably less to the overall percentage of behaviours. Thus the proposition that COMES OFF shows a change in meaning during the six months is given some support, although it could also imply an increase in competence. However, whether it has the potential to take over the role as a SIGNAL for SATIETY is less clear. PUTS SELF ON, as it is described, is not a behaviour which clearly suggests no further feeding. Although the behaviours which do, namely, REFUSES TO OPEN and NO FURTHER SUCKS, together comprise the next largest group following COMES OFF (except at WEEK 24), conclusions regarding this proposal must be left open.

CRY/PROTEST and EYES CLOSING, the remaining two behaviours which were predicted to show a change in meaning with age and possibly perform the role as a potential satiety signal, are behaviours which

TABLE 5.14

PERCENTAGE of BEHAVIOURS PRECEDING and FOLLOWING COMES OFF in BREAST FEEDING INFANTS.

AGE IN WEEKS	1	4	8	12	16	20	24
PRECEDES							
Changes in sk.Patt.	31	32	48	39	38	45	36
Stops sucking	24	26	17	5	3	0	0
Comes off	26	16	14	13	3	0	9
Refuses to Open	2	5	3	0	0	0	0
Eyes Closing	14	16	14	13	6	5	18
Cry/Protest	2	0	0	5	5	0	0
Oral Behaviours/ Other	0	5	3	8	10	0	9
No further sucks	0	0	0	0	0	0	0
Puts self on	0	0	0	17	35	50	27
FOLLOWS							
Changes in sk. Patt.	10	16	31	0	8	0	0
Stops sucking	5	13	7	0	0	0	0
Comes off	26	16	15	13	3	0	9
Refuses to Open	17	26	10	4	15	14	9
Eyes Closing	12	0	3	0	3	0	0
Cry/Protest	7	5	10	9	8	5	18
Oral Behaviours	12	3	0	4	5	0	0
Choke	0	0	3	9	0	5	9
Burps	2	11	3	13	3	0	0
No further sucks	0	11	15	9	15	9	9
Puts self on	10	0	3	39	40	68	45
Total Behaviours	42	38	29	23	40	22	11

occur in both breast and bottle feeding infants. Taking CRY/PROTEST first, in the breast feeding infants at WEEK 1, the preceding behaviours are varied and somewhat random in character (CHANGES IN SUCK PATTERN, COMES OFF, ORAL BEHAVIOURS and itself) but by WEEK 8 the pattern changes to essentially one predominant behaviour, that of COMES OFF (see Table 5.15). A similar initial trend is seen in the following behaviours where there is a variety of possible consequent behaviours (EYES CLOSING, ORAL BEHAVIOURS, BURPS, NO FURTHER SUCKS and a further CRY/PROTEST), but unlike the trend in the preceding behaviours this variable pattern remains. CRY/PROTEST in the bottle feeding infants shows a rather different picture. To start with, it only begins to be observed with any frequency at WEEK 8. Then it is preceded by several behaviours (CHANGES IN SUCK PATTERN, STOPS SUCKING, EYES CLOSING and a further CRY/PROTEST) until by WEEK 16 the predominant behaviour becomes CHANGES IN SUCK PATTERN. The following behaviours show a rather less consistent trend as throughout the age periods when CRY/PROTEST occurs, there are a varied number of consequent behaviours, even though CHANGES IN SUCK PATTERN is the most frequent behaviour. (See Table 5.16).

In neither group of infants, therefore, is there any suggestion that CRY/PROTEST has anything to do with satiety. Nor from this form of analysis can it be said that there is a change in the meaning of the behaviour. If anything comes out of this particular part of the study it is that breast feeding infants CRY or PROTEST when they come off the breast (possibly because they fall off, lose their hold or choke) whilst bottle feeding infants CRY or PROTEST because they have their food source removed. It looks, therefore, as though this behaviour is probably aptly named CRY/PROTEST where a more thorough analysis would be required to decide when the CRY can be said to have

TABLE 5.15

PERCENTAGE of BEHAVIOURS PRECEDING and FOLLOWING CRY/PROTEST in BREAST FEEDING INFANTS.

AGE IN WEEKS	1	4	8	12	16	20*	24*
PRECEDES Changes in sk. Patt.	26.32	Nil	Nil	20.00	16.67		
Stops sucking	Nil	Nil	16.67	Nil	Nil		
Spits teat out	Nil	Nil	Nil	Nil	Nil		
Comes off	31.58	40.00	50.00	60.00	66.67		
Refuses to Open	Nil	Nil	16.67	Nil	Nil		
Eyes Closing	5.26	20.00	Nil	Nil	Nil		
Cry/Protest	15.79	20.00	Nil	13.33	16.67		
Oral Behaviours	15.79	20.00	Nil	Nil	Nil		
Choke	Nil	Nil	Nil	Nil	Nil		
Burps	5.26	Nil	16.67	6.67	Nil		
No further sucks	Nil	Nil	Nil	Nil	Nil		
FOLLOWS Changes in sk. Patt.	Nil	20.00	16.67	33.33	33.33		
Stops sucking	5.26	Nil	Nil	Nil	Nil		
Spits teat out	Nil	Nil	Nil	Nil	Nil		
Comes off	32.00	Nil	Nil	6.67	33.33		
Refuses to Open	Nil	Nil	Nil	Nil	Nil		
Eyes Closing	10.53	Nil	50.00	6.67	Nil		
Cry/Protest	15.79	20.00	Nil	20.00	16.67		
Oral Behaviours	10.53	20.00	Nil	Nil	16.67		
Choke	Nil	Nil	Nil	13.33	Nil		
Burps	10.53	20.00	16.67	13.33	Nil		
No further sucks	15.79	20.00	16.67	6.67	Nil		
Total Behaviours	19	5	6	15	6		

* (WEEKS 20, 24: Too Few Behaviours for Analysis).

TABLE 5.16.

PERCENTAGE of BEHAVIOURS PRECEDING and FOLLOWING CRY/PROTEST in BOTTLE FEEDING INFANTS.

AGE IN WEEKS	1 *	4 *	8	12	16	20	24
PRECEDES Changes in sk. Patt.			37.5	33.33	72.73	84.62	66.67
Stops sucking			37.5	11.11	4.55	Nil	Nil
Spits teat out			Nil	Nil	Nil	Nil	Nil
Comes off			Nil	Nil	Nil	Nil	Nil
Refuses to Open			Nil	Nil	Nil	Nil	Nil
Eyes Closing			12.50	33.33	Nil	15.38	16.67
Cry/Protest			12.50	Nil	18.18	Nil	8.33
Oral Behaviours			Nil	11.11	Nil	Nil	Nil
Choke			Nil	Nil	Nil	Nil	8.33
Burps			Nil	11.11	4.55	Nil	Nil
No further sucks			Nil	Nil	Nil	Nil	Nil
FOLLOWS Changes in sk. Patt.			50.00	11.11	45.45	69.23	33.33
Stops sucking			25.00	Nil	4.55	Nil	Nil
Spits teat out			Nil	Nil	Nil	Nil	Nil
Comes off			Nil	Nil	Nil	Nil	Nil
Refuses to Open			Nil	Nil	4.55	Nil	Nil
Eyes Closing			Nil	22.22	Nil	Nil	16.67
Cry/Protest			12.50	Nil	13.64	Nil	16.67
Oral Behaviours			12.50	33.33	Nil	7.69	Nil
Choke			Nil	Nil	Nil	7.69	16.67
Burps			Nil	33.33	22.73	15.38	8.33
No further sucks			Nil	Nil	9.09	Nil	8.33
Total Behaviours			8	9	22	13	12

* (Weeks 1 and 4: Too Few for Analysis)

become a PROTEST. More generally it can be said that it describes the state of upset.

EYES CLOSING, of all the behaviours analysed in this section perhaps shows the clearest pattern. In both the breast feeding infants (see Table 5.17) and bottle feeding infants (see Table 5.18), EYES CLOSING is predominantly preceded by CHANGES IN SUCK PATTERN. Other behaviours occurring appear relatively infrequently except a further EYES CLOSING at certain age periods. In terms of the following behaviours the trend for CHANGES IN SUCK PATTERN to be the predominent behaviour is still apparent but with rather less overall preponderance. More variation in the other behaviours occurring is more obvious, and in the breast feeding infants there is a suggestion that in the later age periods, COMES OFF takes over as the most frequent behaviour. The suggestion, therefore, that there is a change in the meaning of EYES CLOSING with age is given little support. In the breast feeding infants where there is an altered pattern in the predominent behaviour following EYES CLOSING, the frequency with which the behaviour occurs is minimal. Therefore, to place any confidence in this trend would be premature. Nor is there much support for the idea that it is a signal of satiety in the bottle feeding infant since the following behaviours rarely suggest that there is a stop in feeding. In the breast feeding infants the picture is less clear because at some weeks COMES OFF does occur with more than minimal frequency. The most striking overall impression gained from this analysis, however, is that EYES CLOSING and CHANGES IN SUCK PATTERN are closely linked behaviours possibly forming a pattern of behaviours in their own right.

TABLE 5.17

PERCENTAGE of BEHAVIOURS PRECEDING and FOLLOWING EYES CLOSING in BREAST FEEDING INFANTS.

AGE IN WEEKS	1	4	8	12	16	20	24
PRECEDES Changes in sk. Patt.	73.00	68.00	71.00	78.00	83.33	56.00	75.00
Stops sucking	Nil	3.00	Nil	Nil	Nil	Nil	Nil
Spits teat out	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Comes off	13.00	9.00	10.00	22.00	Nil	Nil	25.00
Refuses to Open	Nil	3.00	3.00	Nil	Nil	Nil	Nil
Eyes Closing	10.00	15.00	3.00	Nil	Nil	33.00	Nil
Cry/Protest	3.00	Nil	10.00	Nil	Nil	Nil	Nil
Oral Behaviours	Nil	3.00	Nil	Nil	Nil	Nil	Nil
Choke	Nil	Nil	3.00	Nil	16.67	11.00	Nil
Burps	Nil	Nil	Nil	Nil	Nil	Nil	Nil
No further sucks	Nil	Nil	Nil	Nil	Nil	Nil	Nil
FOLLOWS Changes in sk. Patt.	57.00	56.00	58.00	45.00	33.33	Nil	25.00
Stops sucking	13.00	9.00	3.00	22.00	16.67	Nil	Nil
Spits teat out	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Comes off	17.00	15.00	10.00	33.00	50.00	11.00	50.00
Refuses to Open	Nil	Nil	10.00	Nil	Nil	Nil	Nil
Eyes Closing	10.00	15.00	3.00	Nil	Nil	33.00	Nil
Cry/Protest	Nil	3.00	Nil	Nil	Nil	22.00	Nil
Oral Behaviours	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Choke	Nil	Nil	6.00	Nil	Nil	11.00	25.00
Burps	Nil	Nil	10.00	Nil	Nil	Nil	Nil
No further sucks	3.00	3.00	Nil	Nil	Nil	22.00	Nil
Total Behaviours	30	34	31	9	6	9	4

TABLE 5.18

PERCENTAGE of BEHAVIOURS PRECEDING and FOLLOWING EYES CLOSING in BOTTLE FEEDING INFANTS.

AGE IN WEEKS	1	4	8	12	16	20	24
PRECEDES Changes in sk. Patt.	56.30	71.00	68.00	53.00	88.00	100.00	75.00
Stops sucking	12.50	21.00	4.00	Nil	13.00	Nil	Nil
Spits teat out	Nil	Nil	Nil	11.00	Nil	Nil	Nil
Comes off	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Refuses to Open	Nil	4.00	4.00	Nil	Nil	Nil	Nil
Eyes Closing	12.50	Nil	24.00	21.00	Nil	Nil	Nil
Cry/Protest	Nil	Nil	Nil	5.00	Nil	Nil	25.00
Oral Behaviours	6.25	Nil	Nil	Nil	Nil	Nil	Nil
Choke	Nil	4.00	Nil	5.00	Nil	Nil	Nil
Burps	12.50	Nil	Nil	5.00	Nil	Nil	Nil
No further sucks	Nil	Nil	Nil	Nil	Nil	Nil	Nil
FOLLOWS Changes in sk. Patt.	50.00	59.00	40.00	47.00	61.00	44.45	77.00
Stops sucking	6.25	17.00	8.00	16.00	13.00	Nil	Nil
Spits teat out	Nil	Nil	Nil	Nil	13.00	Nil	Nil
Comes off	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Refuses to Open	12.50	4.00	12.00	5.00	Nil	Nil	Nil
Eyes Closing	18.75	4.00	28.00	12.00	13.00	Nil	Nil
Cry/Protest	Nil	Nil	4.00	16.00	Nil	11.11	11.50
Oral Behaviours	Nil	Nil	Nil	Nil	Nil	11.11	Nil
Choke	Nil	8.00	Nil	Nil	Nil	Nil	Nil
Burps	6.25	8.00	4.00	5.00	Nil	22.22	Nil
No further sucks	6.25	Nil	4.00	Nil	Nil	11.11	11.50
Total Behaviours	16	24	25	19	8	9	8

5.5 DISCUSSION

The discussion develops from essentially two general findings. Firstly there is the nature of the behaviours present and their potential availability to act as signals of satiety. What has been found is that behaviours appear to vary in their frequency of occurrence according to the age of the infant and according to the technique. Twelve to 16 weeks was tentatively suggested as the age when some change occurs. Interestingly it coincides with Ripin's (1930) third stage of development in feeding, when the infant is now said to be capable of reacting specifically to the feeding situation. The actual changes observed in the small number of infants studied are various. In the breast feeding infants some behaviours appeared to become considerably less frequent (CHANGES IN SUCK PATTERN and EYES CLOSING), whilst one behaviour tended to drop out of the feeding repertoire (STOPS SUCKING). Two behaviours were present throughout the six months either with considerable frequency (COMES OFF) or with a degree of consistency, albeit with rather lowered frequency (CRY/PROTEST). Whilst four behaviours were neither likely to be seen in a high percentage of infants, nor occurred with any apparent pattern over the six months. (REFUSES TO OPEN, ORAL BEHAVIOURS, CHOKE and BURPS). In the bottle feeding infant, in contrast, the age factor was rather more blurred. Only STOPS SUCKING showed any real trend, sharing the characteristic with the breast feeding infant of dropping out of the repertoire. In two other behaviours there was only a tentative suggestion of an age trend, and only after WEEK 1. (CHANGES IN SUCK PATTERN and EYES CLOSING). The other behaviours reflected a similar pattern to that shown in the breast feeding infants.

The second finding concerns the potential nature of the signals available. It has been tentatively suggested that two states are signalled by the infant, namely, satiety and upset. Satiety appeared to be indicated by STOPS SUCKING, REFUSAL TO OPEN and COMES OFF and upset by CRY/PROTEST. Again, because the sample studied was small, no firm conclusions could be drawn. Nevertheless it did seem that the factors influencing the infant's capacity to use these potential signals were also related to age and technique. At around 12 - 16 week period, as STOPS SUCKING was observed to drop out and REFUSAL TO OPEN became considerably less frequent, COMES OFF was considered to have the potential to take over this role in the breast feeding infant, although it could not be conclusively shown to be effective. But there was no comparable behaviour available in the bottle feeding infant.

Other workers have also proposed that feeding technique alters the infant's behaviour. Peiper (1961) speculates that the expression of satiety is best suited to breast feeding infants since it is only reliably represented by fatigue resulting from the effort needed to suck. This proposal was supported by the earlier suggestion of Halversons's (1938), that breast feeding does require more force. Indeed more recently Kaye (1967) has confirmed the view that the sucking mechanisms used when breast or bottle feeding are quite different. However, although from this study it does look as though the breast feeding infant may be at an advantage behaviourally, it appears more strongly in the form of COMES OFF and in the older age period. The role of effort as the cause of satiety is much less clear. In the breast feeder, even in the early weeks the feeds get shorter, yet the infant takes more. (See Appendix III).

In addition, the older infant spends more time coming off and putting himself on. This is not a picture of fatigue from effort. Equally, differences found in the potential satiety signals of the younger infant are not that the signals are present in the breast feeding infants and absent in the bottle feeding infants, but rather that their expression is different in the two groups. This is particularly true of STOPS SUCKING. Before WEEK 12, whilst the preceding behaviours are comparable, in the bottle feeding infants there is both a greater variety of behaviours following STOPS SUCKING and an increased likelihood that feeding will continue. It is difficult to see how the presence of fatigue in the breast feeder could account for this difference since it does not explain why the bottle feeder should stop sucking in the first place.

An alternative explanation might be that differences result from the way the potential signals affect the receiver, making the deciding factor the mother's behaviour. Either she does not perceive the signal, she misinterprets it, or she interprets it but acts to counteract it. One would, therefore, predict differences in the mother's response, solely on the basis of technique. Another possibility is that whatever characteristics feature in bottle feeding, they interfere with the natural expression of satiety. What of course is absent in the experience of the bottle feeder is any change in the composition of milk during the feed. Unfortunately this thesis is not exploring the learning potential of this factor, other than by assuming its presence or absence. Elsewhere this aspect is under test. (Wright, Crow and Fawcett, 1977). The only result which suggests that factors inherent in the technique might be influencing the expression of behaviour is the finding that

whereas in the breast feeding infant the overall frequency in which the behaviours occur appears to show some correlation with the amount of milk taken at the feed, the overall frequency in behaviour in the bottle feeding infants shows its relationship more with the length of the feed.

Developmental issues emerging from the general results are the possibility that bottle feeding infants might miss out on some opportunity to improve or increase their skill in feeding, or that there is a delay in the process. But all that can be said is that the age trends found in CHANGES IN SUCK PATTERN and EYES CLOSING suggesting a less obvious change in occurrence over the six months in the bottle feeding infants, points to the possibility that some necessary feature for development might be absent. Whilst the fact that STOPS SUCKING drops out rather later in the bottle feeder suggests that there may be a delay in the developmental process. Delay could be a consequence of a lack of opportunity for the bottle feeding infant to exercise independent behaviour and so, as has been suggested in the literature (Piaget 1936; Bower 1974), inhibit the acquisition of skill. Some tentative support for this speculation comes from the finding that in the bottle feeding infant there is no comparable behaviour to COMES OFF and there is a delay in the presence of CRY/PROTEST until WEEK 8. Both behaviours give the breast feeding infant the potential to control the direction in which the feed takes. Alternatively, mother could provide the bottle feeding infant with incorrect learning experiences through her response, thus interfering with development and so removing possible opportunities available for development in skill. This is the essence of Bruch's (1974) proposal regarding faulty learning experiences in infancy leading to obesity.

Suggestions regarding the possible nature of some of the developmental processes which might be involved come from several workers. Gesell and Ilg (1937) in their observations of the age factors concerned in the expression of satiety, found that it first appeared as falling asleep, then as the infant was said to mature it became exhibited in head withdrawal and frank refusal. (4 weeks). Interest in surroundings was the next stage, appearing around 16 - 20 weeks, until by 24 weeks there was a more general negative response such as arching of the back accompanied by screams. What they describe is in fact the development of voluntary responses to satiation of increasing complexity from about three to four weeks. It was unfortunate that these workers made no clear distinction in their description between the possible differences in technique and that they also included in their behavioural categories, responses to spoon feeding. However, the general picture which emerged may well explain why STOPS SUCKING as a satiety signal disappears from the repertoire. It is not a behaviour that compares with the complexity of those described by Gesell and Ilg in the older infant. What of course a frequency analysis of behaviour cannot capture is the qualitative change in the expression of behaviour. But the idea of interest in surroundings would give meaning to the COMES OFF/ PUTS SELF ON sequence of the breast feeding infant found in this study at approximately the age at which it was observed by Gesell and Ilg. The question, therefore, arising is whether it is given in some other form in the bottle feeding infant which this study has failed to show or is indeed suppressed. Interestingly, the milestone relating to REFUSAL TO OPEN said by Gesell and Ilg only to appear at WEEK 4 is not replicated. In this study it occurs in the first week of life and is in line with the findings of

Dubignon and Campbell (1969).

The suggestion that crying comes to be used as a protest and thus also reflects a trend in the development of voluntary control in the feed, comes from the work of Wolff (1969). In a study of bottle feeding infants he found that crying is used as a protest at interruption of the feed from the second to the fifth week, drops out and then returns by becoming associated with the taste or texture of solid foods. In this study CRY/PROTEST only really becomes frequent in the bottle feeding infant in WEEK 8 and then its frequency is maintained for the remainder of the six months, thus questioning Wolff's findings. The picture in the breast feeding infants is more in keeping with the early trends in Wolff's observation, although CRY/PROTEST occurs with considerable frequency even in WEEK 1. There is a suggestion that CRY/PROTEST is related to interruptions in the feed, support coming from the finding that the most likely consequent behaviour was feeding.

The one remaining factor to be discussed which does not neatly fit into either of the issues raised, is the finding that at WEEK 1 there is a fairly clear difference in the nature of behaviour between the breast and bottle feeders. Not only is there a significant difference between the overall frequencies of the behaviours, but these differences also appear in CHANGES IN SUCK PATTERN, STOPS SUCKING and CRY/PROTEST. As Bernal and Richards (1970) suggested, it appears that in the first ten days of life, the breast feeding infant is hungrier than the bottle feeding infant. In a study reported elsewhere (Crow and Wright, 1976) it was shown that the bottle feeding infant tends to have a larger milk intake than the breast feeding infant, thus supporting Bernal and Richard's proposal. The possible reason for the behavioural differences observed in this

study at WEEK 1 could well be a consequence of the implications from both these studies. Because the breast feeder is hungrier he is more aroused and, therefore, more active. Whereas the bottle feeder, because of the increased intake is lethargic and bloated. The developmental consequences remain an open question.

Thus, in conclusion in addition to the original hypotheses set up, it would seem that there are differences in how the mother behaves towards the infant according to the technique. Equally, although STOPS SUCKING, REFUSAL TO OPEN, COMES OFF, CRY/PROTEST, EYES CLOSING and CHANGES IN SUCK PATTERN have the potential to act as signals, this says nothing about their effects on the mother or the mother's influence on them. Their capacity to act as a signal is, therefore, not appraised. The next chapter will look at these aspects.

CHAPTER SIX.

MOTHER'S BEHAVIOUR IN RELATION TO THE INFANT'S BEHAVIOUR

6.1 INTRODUCTION.

Even though infant behaviours have the potential to act as signals, this says nothing about how they influence the receiver and thus their signal value. Therefore, to assess this, and to appraise the part the caretaker plays in the infant's expression of satiety, one must look at the receiver (Mother) and observe the behavioural response which is evoked. (Cullen (1972)). Measurement of this poses problems in decisions about whether the behaviour of the receiver is indeed a response to the signal and what meaning the receiver gives to the signal. One has to face the fallacy inherent in the example of the two church clocks. Because clock A chimes immediately before clock B, it does not prove that clock A caused clock B to chime. Thus, simply because a mother does something immediately after the infant, it cannot necessarily be claimed that the infant caused her to behave in that way. Only experimental manipulation will fully meet the demands of this situation, particularly if one is looking for explanations in terms of a common factor such as are required when explaining their motivational origin. However, if the mother consistently behaves in a certain way following specific infant behaviours, then whatever the cause, they can nevertheless be said to be related to each other. In fact, it is doubtful whether it would even be justified to assume that the behaviours share a common causal factor because whilst mothers do give meaning to their infant's behaviour, the source of their interpretation can be far wider than the context within which the behaviour actually occurs. (Richards 1974). The challenge is

thus initially to identify the forms in which the related mother behaviours occur.

The meaning given to the signal can be assessed in several ways. One can look at what mothers do and then describe the signal value in terms of the outcome for the infant. Or one can ask mother to describe her actions and through this get her to provide her interpretation of the infant's behaviour. The problem with the latter technique is that it could have the effect of (a) drawing the mother's attention to what is being observed and thus altering the nature of her subsequent actions and (b) of producing an answer for the sake of an answer which in no way reflects the mother's real understanding or lack of it. Thus the former approach was chosen; the meaning of a signal being inferred from what behaviour it evokes in the mother. Nor was it a requirement that mother knew what she was responding to, merely that she did so.

The mother behaviours chosen for this part of the study were behaviours which, during the pilot study, were observed to be those most relevant. Thirteen behaviours emerged, including various forms of stimulation to suck, winds, and removes teat described by other workers. (Richards and Bernal 1972).

These were:-

Stimulates to suck;

Nipple or teat over infant's lips;

Offers nipple or teat;

Puts the infant on the breast;

Pushes the teat/nipple in;

Teat in/out sequence;

Removes teat/takes off the nipple;

Decides to finish the feed;

Pauses;

Winds the infant;

Changes the breast offered;

Comments;

Other: includes inspects infant, soothes infant and gives solids within milk feed.

Definitions of these behaviours are given in Chapter 4.

In describing the outcome which these mother behaviours were observed to have for the infant it became apparent that they could be grouped into four categories; two similar forms having also been used in an earlier study by Ainsworth and Bell (1969). Together, with their relevant behaviours, these are:-

INFANT DETERMINES OUTCOME

nipple/teat over lips

offers nipple/teat

pauses

decides to finish the feed

MOTHER CONTROLS OUTCOME

stimulates

pushes the teat/nipple in

teat in/out sequence

puts the infant on the breast

FEED INTERRUPTED

removes teat/takes off the nipple

winds

changes the breast offered

MOTHER ATTENDS TO INFANT

comments on infant's behaviour

The only behavioural category not included in this subsequent categorisation is OTHER. The behaviours within it occurred too infrequently to warrant further categories of their own and yet did not fit appropriately into any of the selected categories. Thus, when the results are analysed according to these categories, not all percentages will add up to 100%., when expressed in terms of total number of Mother-baby related behaviours occurring.

As was described in Chapter 3, it was also apparent that mother's behaviour occurred when no apparent preceeding infant behaviour could be observed, yet the outcome of this behaviour could have consequences for the progress of the feed. Therefore, in addition to the categorisation of Mother-baby related behaviours, Mother's behaviour was separately grouped into Mother-baby related behaviours and Mother independent behaviours. One other final feature which was noted in the breast feeding mothers was whether they looked at their watches or commented on the time immediately before they took the infant off the breast. Both the occasion and the time were recorded.

6.2 METHOD.

Mother behaviours were recorded from the video-recordings of the feeds as they occurred using the paper and pencil method of scoring. They were scored on the same checklist as that used for the infant behaviours.(See Appendix II). All occurrences of the selected behaviours were scored within both the Mother-baby related behaviours and Mother independent behaviours.

Problems arose in some instances when mothers stimulated their infants to suck. Most mothers engaged in this behaviour at discrete intervals so that it was easy to score the number of times it occurred. However, a few mothers, who were principally bottle

feeders, were idiosyncratic in their method of feeding. They would turn or twist the teat of the bottle throughout the feed thus formally stimulating the infant to suck continuously. On these occasions it was decided that one stimulation would be scored for each period of the feed. In this way, the probable effect was to underestimate the amount of stimulation engaged in by the bottle feeding mothers by arriving at a rather conservative estimate.

The sequence of events was maintained by numbering each behaviour as it occurred, as in the recording of the infant behaviours, and scored in terms of the place in the feed. Mother independent behaviours were identified by recording them in a different coloured pencil. Only a Mother behaviour immediately following an Infant behaviour was scored as a Mother-baby related behaviour.

6.3 POTENTIAL SIGNALLING CAPACITY OF INFANT BEHAVIOURS.

To establish the nature of the relationship between the Infant behaviours and the Mother behaviours, the frequency with which Infant behaviours were followed by Mother behaviours was computed. A response index was first estimated by dividing the number of Mother behaviours (of any nature) by the number of Infant behaviours and then multiplied by a hundred. Thus,

$$\text{Response Index} = \frac{\text{No. of Mother-baby related behaviours}}{\text{No. of Infant behaviours}} \times 100$$

This procedure was adopted to take into account the individual differences in the frequency with which infant behaviours occurred across the infants studied. The response indices for each group were then calculated and are presented in Table 6.1.

The relationship between the Infant behaviours and the Mother behaviours appeared to fall roughly into three groups. There was a relationship where the response index was always above 70, another

TABLE 6.1

Response Indices of MOTHER-BABY RELATED BEHAVIOURS for INFANT BEHAVIOURS by AGE of INFANT and TECHNIQUE.

INFANT BEHAVIOURS	WEEK 1	WEEK 4	WEEK 8	WEEK 12	WEEK 16	WEEK 20	WEEK 24
BREAST FEEDERS:							
Changes in sk. Patt.	36	25*	28	8	9	0	0
Stops sucking	95	77	39*	50	NA[2]	NR[1]	0
Comes off	100	91	76	54	74	62	80
Refuses to Open	100	100	100	100	100	100	NA
Eyes Closing	23	18	38	0	17	40	0
Cry/Protest	72	100	92	87	75	100	NA
Oral Behaviours	95	100	100	50	33	NA	NR
Choke	73	100	85	NA	83	67	NA
Burps	0	67	83	75	100	NA	0
BOTTLE FEEDERS:							
Changes in sk. Patt.	66	60*	36	35	36	28	26
Stops sucking	100	87	83*	74	90	50	NA
Spits teat out	NA	100	NA	100	100	NA	NA
Refuses to Open	100	100	100	100	100	NA	NR
Eyes Closing	58	60	45	22	8	38	20
Cry/Protest	NA	NA	88	100	90	92	100
Oral Behaviours	89	NA	NA	84	NA	NA	NR
Choke	100	100	NR	NA	NR	75	71
Burps	25	63	100	100	100	83	83

1. NA Too few infant behaviours to compute score.

2. NR No infant behaviours scored.

* p = .05 Mann-Whitney U Two Tailed Test. (Siegal, 1956)

where the response index was always below 40, and a third where it was variable, ranging from 100 to 40.

Infant behaviours falling into the high response index category were REFUSES TO OPEN, CRY/PROTEST and CHOKE in both breast and bottle feeders, whilst in addition, the bottle feeding mothers responded frequently to SPITS THE TEAT OUT, when it occurs, and rather more frequently to STOPS SUCKING between WEEKS 1 - 16.

The Infant behaviours falling into the low response index category occurred only in breast feeders and were CHANGES IN SUCK PATTERN and EYES CLOSING.

The Infant behaviours where there was a variable response index in breast feeders included COMES OFF, STOPS SUCKING, ORAL BEHAVIOURS and BURPS, and in bottle feeders, CHANGES IN SUCK PATTERN, EYES CLOSING and BURPS.

Thus, the Infant behaviours which appeared to be most strongly related to Mother behaviours whatever the age of the infant and the method of feeding, and, therefore, potentially showing the highest signalling capacity were REFUSES TO OPEN, CRY/PROTEST and CHOKE. Otherwise the response indices showed variations at different age periods and, in comparable behaviours, according to the technique.

Age factors in the response index were difficult to test statistically in this study because not all Infant behaviours occur at each age in each infant. The problem resulting is that a Nil in the response index arises both when there are no Infant behaviours and no Mother behaviours invalidating the rating score required for the computation of the Friedman Two-say analysis of variance. The only Infant behaviours analysed statistically were thus CHANGES IN SUCK PATTERN and COMES OFF as they were the only ones occurring consistently over the seven age periods. What emerged from this

rather limited analysis was that COMES OFF showed no age effects, but CHANGES IN SUCK PATTERN did. In both breast and bottle feeding mothers, there appeared to be a steady decline in the response index, with the trend reaching significance in the breast feeders ($p < .05$).

Differences arising when comparing the response indices according to technique were more apparent in three of the Infant behaviours. There was a suggestion from the results in Table 6.1 that bottle feeding mothers have a higher response index in CHANGES IN SUCK PATTERN, STOPS SUCKING, and, in the early weeks, to EYES CLOSING. At WEEK 4, differences reach statistical significance in CHANGES IN SUCK PATTERN ($U = 16$; $p = .05$), and at WEEK 8 in STOPS SUCKING ($U = 7$; $p = .05$).

Differences in the degree to which Infant behaviours are related to Mother behaviours, therefore, suggest that they may have something to do with characteristics inherent in the feed. Infant behaviours where the response index appears to be high, whatever the technique, are those which could be interpreted as signalling distress (CRY/PROTEST), danger or potential distress (CHOKE), or refusal to continue feeding (REFUSES TO OPEN). All these Infant behaviours share a common characteristic in that they occur when the infant is not feeding and, because of the high response indices, could be thus said to reflect unambiguously a state or an event. Whereas those Infant behaviours occurring in relation to infant sucking, namely, CHANGES IN SUCK PATTERN, EYES CLOSING and STOPS SUCKING, whilst they show variable response indices, the higher rates tend to be found in the bottle feeders. This is seen throughout the six month period in CHANGES IN SUCK PATTERN, in the early weeks for EYES CLOSING, and from WEEK 8 for STOPS SUCKING. Together this trend tentatively suggests that where there may possibly be differences according to the technique is in the bottle feeding mothers who are more likely

to respond to Infant behaviours occurring whilst the nipple/teat is in the infant's mouth. These possible differencies in Mother behaviours do not seem to be related to any overall tendency for bottle feeding mothers to show more behaviours relative to the overall frequency of their infant's behaviour, as it can be seen from Table 6.2 that when the gross response indices of each mother are compared there is only a statistically significant difference at WEEK 12 ($U = 7$; $p = .02$).

Nor does it look as though differences across the technique can be explained in terms of the bottle feeding mother's greater overall tendency to be more active during the feed than the breast feeding mother. Through examination of the correlations between the Mother-baby related behaviours and Infant behaviours, it can be seen from Table 6.3 that only at WEEKS 16 and 20 are the bottle feeders' correlations statistically significant when the breast feeders are not. To fulfil the prediction one would have expected the breast feeders to have shown consistently low levels of correlation throughout the six months. Through an examination of the correlations between the overall frequency of the Mother-baby related behaviours with the overall frequency of the Mother independent behaviours a similar conclusion was drawn. One would again have expected a low correlation in the breast feeders and a high correlation in the bottle feeders for the general tendency to be a reality. From Table 6.4 what is apparent is that whilst there is little correlation between the frequency of Mother-baby related behaviours and Mother independent behaviours in the breast feeding mothers, in the bottle feeding mothers there appears to be a reversal of what was expected in the early weeks (that is a significant negative correlation) and low correlations from WEEK 8.

TABLE 6.2

Mother-baby related behaviours, infant behaviours and comparative analysis of mother-baby related behaviour by AGE and TECHNIQUE.

AGE IN WEEKS	TOTAL NO. of Mother-baby behaviours		TOTAL NO. of Infant behaviours		DIFFERENCES between Mother-baby related behaviours.[1]
	Breast	Bottle	Breast	Bottle	
1 Br. N= 11 Bt. N= 9	159	79	254	105	U = 34 NS
4 Br. N= 11 Bt. N= 8	114	97	231	141	U = 27 NS
8 Br. N= 10 Bt. N= 9	93	67	185	129	U = 42 NS
12 Br. N= 6 Bt. N= 10	35	74	98	116	U = 7 p = .025*
16 Br. N= 9 Bt. N= 9	56	56	107	89	U = 36 NS
20 Br. N= 6 Bt. N= 10	28	43	69	82	U = 19 NS
24 Br. N= 3 Bt. N= 10	15	32	34	72	U = 16.5 NS

1. Formula used for comparison:

$$\frac{\text{Total No. of Mother-baby related behaviours}}{\text{Total No. of Infant behaviours}}$$

* p = .025 Mann-Whitney U Two Tailed Test. (Siegal, 1956)

TABLE 6.3

Correlation between Mother-baby related Behaviours and Infant Behaviours.

AGE IN WEEKS	BREAST	BOTTLE
1	$r_s = .73^{****}$	$r_s = .82^{***}$
4	$r_s = .72^{***}$	$r_s = .79^{*}$
8	$r_s = .62^{*}$	$r_s = .64^{***}$
12	$r_s = .78^{*}$	$r_s = .86^{****}$
16	$r_s = .39$	$r_s = .79^{**}$
20	$r_s = .32$	$r_s = .67^{**}$
24	TOO FEW MOTHERS.	$r_s = .48$

r_s = Spearman Rank Correlation Coefficient One-Tailed Test (with correction for ties).

**** Significant at .005 level

*** Significant at .01 level

** Significant at .025 level

* Significant at .05 level

TABLE 6.4

Correlation between Mother-baby related Behaviours and Mother Independent Behaviours by AGE and TECHNIQUE.

AGE IN WEEKS	BREAST	BOTTLE
1	r_s = .20	r_s = -.73**
4	r_s = -.197	r_s = -.73**
8	r_s = -.188	r_s = -.179
12	r_s = -.41	r_s = .269
16	r_s = .041	r_s = .20
20	r_s = .014	r_s = .22
24	NA	r_s = .49

** Significant at .025 level

r_s = Spearman Rank Correlation Coefficient One Tailed Teat (with correction for Ties).

Differential rates in the Mother's behaviour related to the Infant's behaviour does not, therefore, look as though it is simply a reflection of any generally increased rate of activity in the bottle feeding mother. Characteristics related to the technique may, therefore, have a rather more specific pattern than this.

6.4 CHARACTERISTICS OF MOTHER-BABY RELATED BEHAVIOURS.

To explore the characteristics of Mother-baby related behaviours in terms of more specific factors, the frequencies of the Mother-baby related behaviours were first considered in terms of their percentage distribution at each age within the four categories of mother behaviour which describe, in a general sense, observed consequences of the behaviour for the infant. From this analysis, differences did emerge, and were more evident in the group INFANT DETERMINES OUTCOME and the group MOTHER CONTROLS OUTCOME.

From Table 6.5 it can be seen that there is a tendency for the breast feeding mothers to show more Mother-baby related behaviours in the category INFANT DETERMINES OUTCOME, and for the bottle feeding mothers to show more Mother-baby related behaviours in the category MOTHER CONTROLS OUTCOME. In the early and later weeks the relevant differences are statistically significant respectively.

There may be several reasons for these suggestive trends. It could simply be an artefact of the method of analysis since not every category used to describe outcome is equally represented by Mother behaviours related to both bottle feeding or breast feeding. The result could thus merely reflect this uneven distribution. However, on closer inspection of the categories in question this explanation does not look as though it entirely holds up. Whereas indeed in the category MOTHER CONTROLS OUTCOME three out of the four behaviours

TABLE 6.5

Percentage Distribution of Mother-Baby Related Behaviours according to categories of MOTHER BEHAVIOUR

AGE IN WEEKS	INFANT DETERMINES OUTCOME		MOTHER CONTROLS OUTCOME		INTERRUPTS FEED		ATTENDS TO INFANT	
	BREAST	BOTTLE	BREAST	BOTTLE	BREAST	BOTTLE	BREAST	BOTTLE
1 Br. N= 11 Bo. N= 9	29% (46)	23% (18)	51% (81)	53% (42)	20% (32)	20% (16)	0	0
4 Br. N= 11 Bo. N= 8	34%** (39)	5%** (5)	45% (51)	69% (67)	19% (22)	22% (21)	1% (1)	1% (2)
8 Br. N= 10 Bo. N= 9	29% (27)	16% (11)	39% (36)	51% (34)	18% (17)	27% (18)	5% (5)	4% (3)
12 Br. N= 6 Bo. N= 10	46% (16)	22% (16)	6% (2)	43% (32)	26% (9)	23% (17)	14% (5)	7% (5)
16 Br. N= 9 Bo. N= 9	45%*** (25)	18%*** (10)	13%*** (7)	27%*** (15)	25% (14)	43% (24)	13% (7)	9% (5)
20 Br. N= 6 Bo. N= 10	68%** (19)	23%** (10)	** 0	28%** (12)	25% (7)	(28% (12)	7% (2)	9% (4)
24 Br. N= 3 Bo. N= 10	60% (9)	34% (11)	0 0	25% (8)	20% (3)	22% (7)	20% (3)	6% (2)

** p = .05 level of significance. *** p = .025 level of significance.
Mann-Whitney - U Test, Two-Tail Test.

are observed in the bottle feeding mothers and only two in the breast feeding mothers, in the category INFANT DETERMINES OUTCOME all four behaviours occur in both groups of mothers.

An alternative possibility is that it is a consequence of the Infant's behaviour and, therefore, something to do with the potential signal value of these behaviours. To test this proposition the Chi-squared one sample test was applied using the following method. As there are ten categories of Mother response behaviours making up the four groups, to calculate the expected frequency of Mother-baby related behaviours for each group, the total number of behaviours related to each Infant behaviour was first divided by 10. This was to overcome the fact that not all groups included an equal number of Mother-baby related behaviours. The figure obtained was then multiplied by the number of classes of Mother-baby related behaviours represented in the particular category under consideration, thus arriving at the expected frequency.

No statistical calculation was made for SPITS THE TEAT OUT, EYES CLOSING (Breast), ORAL BEHAVIOURS, CHOKE and BURPS because the expected frequencies were too small. Also, age was ignored for the purposes of this analysis in an attempt to establish whether there were any apparent trends in the relationship between Mother and Infant behaviours. The frequencies would have been too small for any independent analysis at each period.

As can be seen from Table 6.6, trends are apparent. In the breast feeding group, COMES OFF and REFUSES TO OPEN are the Infant behaviours which appear to show a tendency to be more related to the Mother behaviours in the category INFANT DETERMINES OUTCOME, with a statistically significant distribution of $p < .001$ and $p < .01$ respectively. CHANGES IN SUCK PATTERN, STOPS SUCKING and EYES CLOSING

TABLE 6.6

Categories of Mother-baby related Behaviours in terms of Infant Behaviours.

INFANT BEHAVIOURS	INFANT DETER-MINES OUTCOME	MOTHER CONTROLS OUTCOME	FEED INTER-RUPTED	MOTHER ATTENDS TO INFANT	SIGNIFI-CANT LEVEL *
BREAST Changes in sk. Patt.	0	79	3	3	$p < .001$
Stops sucking	1	40	5	0	$p < .001$
Comes off	96	19	32	10	$p < .001$
Refuses to open	37	12	13	0	$p < .01$
Eyes closing	2	18	5	5	-
Cry/Protest	12	4	26	4	$p < .01$
Oral Behaviours	13	5	8	0	-
Choke	15	0	10	1	-
Burps	5	0	6	3	-
TOTAL	181	177	108	26	
BOTTLE Changes in sk. Patt.	0	103	8	12	$p < .001$
Stops sucking	0	34	24	0	$p < .001$
Spits Teat out	13	4	7	0	-
Refuses to open	31	24	6	0	$p < .01$
Eyes closing	4	30	5	7	$p < .001$
Cry/Protest	20	7	32	1	$p < .001$
Oral Behaviours	6	0	7	0	-
Choke	0	5	8	0	-
Burps	15	2	16	2	-
TOTAL	89	209	113	22	

* x^2 One Sample Test (Siegal, 1956)

present a distribution which suggests that they are most closely related to the Mother behaviours in the category MOTHER CONTROL, with a statistically significant distribution of $p < .001$ in CHANGES IN SUCK PATTERN and STOPS SUCKING. Whilst CRY/PROTEST appears to be linked with the Mother behaviours in the category FEED INTERRUPTED, significant at $p < .01$ level. None of the other behaviours occur frequently enough to suggest any obvious trend which could not have occurred simply by chance.

In the bottle feeding infants, trends are apparent, but not entirely in line with the breast feeding infants. Whilst similar trends appear in the Infant behaviours CHANGES IN SUCK PATTERN (with $p < .001$), EYES CLOSING (with $p < .001$) and CRY/PROTEST (with $p < .001$), this is not the case in STOPS SUCKING and REFUSES TO OPEN. Instead of showing a trend in distribution such that the majority of behaviours occur in one of the Mother categories, they both appear to show a distribution which suggests a relationship between two categories. STOPS SUCKING looks as though it is as likely to be related to MOTHER CONTROLS OUTCOME as it is to FEED INTERRUPTED (with $p < .001$) and REFUSAL TO OPEN with the categories INFANT DETERMINES OUTCOME and MOTHER CONTROLS OUTCOME (with $p < .01$). Again none of the other behaviours occur frequently enough to suggest any obvious trends which could not have occurred simply by chance.

What thus emerges is that there is some support for the suggestion that the nature of the potential infant signals is possibly related to differences in how breast and bottle feeding mothers behave. That breast feeding mothers seem to show more behaviour in the category INFANT DETERMINES OUTCOME is probably due to the infant behaviour COMES OFF. It is an infant behaviour which has already been shown only to occur in breast feeders and represents 5% of all the infant

behaviours related to this Mother category. It also occurs more frequently (96) than the total frequency of bottle feeding infant behaviours related to this mode (89). There is no comparable behaviour in the bottle feeding infant's repertoire. The most frequently occurring infant behaviour, REFUSAL TO OPEN, only accounts for 35% of all infant behaviours related to this Mother category, in observed frequency is thus considerably less than COMES OFF, and also has the other characteristic that it is as likely to be related to the additional Mother category of MOTHER CONTROLS OUTCOME.

The reason why the bottle feeding mothers appear to show relatively more behaviour in the category MOTHER CONTROLS OUTCOME is less clear cut. There is no obvious infant behaviour which can, on its own, possibly account for the suggested differences evident. Whereas CHANGES IN SUCK PATTERN accounts for 49% of all infant behaviours in the bottle feeding group, its percentage distribution is 45% in the breast feeding group and thus not strikingly different. The answer may, therefore, lie in a greater tendency of the bottle feeding mothers to behave in this mode of MOTHER CONTROLS OUTCOME overall to the relevant potential infant signals. For, whereas in the breast feeding mothers, the category MOTHER CONTROLS OUTCOME includes 36% of all the Mother-baby related behaviours, the percentage distribution is 48% in the bottle feeding group and thus larger but not significantly so.

To pursue this proposition, the relationship between the mother and infant's behaviour was looked at more closely. From Table 6.7 and 6.8, what emerges is that in general terms, no breast feeding mother was observed to push the nipple into the infant's mouth, thus illustrating why there are three Mother-baby related behaviours in the MOTHER CONTROLS OUTCOME category in the bottle feeding mothers, and only two in the breast feeding mothers. When the percentage distribution

TABLE 6.7

Breast Feeders: Infant behaviours and the Mother-baby related behaviours.

	Stimulates	Takes Off	Nipple over Lips	Offers Nipple	Pauses	Winds	Decides to Finish	Mother Comments	Puts On	Changes Breast
Changes in Suck Pattern	79	3						3		
Stops Sucking	40	5			1					
Comes Off	4		8	41	33	28	14	10	15	4
Refuses to Open	10		7	8	8	9	14		2	4
Eyes Closing	18	5		1	1			5		
Cry/Protest				11		16	1	4	4	10
Oral Behaviours				13		5			5	3
Choke				3	12	10		1		
Burps				3	2	3		3		3
TOTAL	151	13	15	80	57	71	29	26	26	24

TABLE 6.8

Bottle Feeders: Infant behaviours and the Mother-baby related behaviours.

	Stimulates	Teat Removed	Teat over Lips	Teat Offered	Pauses	Winds	Decides to Finish	Mother Comments	Pushes Teat in	Teat out/in
Changes in Suck Pattern	89	8						12		14
Stops Sucking	29	19				5				5
Spits Teat out		2	4	2	3	5	4		4	
Refuses to Open	15		17		7	6	7		9	
Eyes Closing	27	2	2		2	3		7		3
Cry/Protest		6	4	15		26	1	1	5	2
Oral Behaviours			2	3		7	1			
Choke		2				6				5
Burps			4	6	2	16	3	2	2	
TOTAL	160	39	33	26	14	74	16	22	20	29

of the Mother behaviours was then appraised what emerged was that in breast feeding Mothers STIMULATES comprises 31% of all behaviours, and PUTS ON 5% of all behaviours. In bottle feeding Mothers, STIMULATES comprises 37% of all behaviours, PUSHES IN 4.5% and TEAT IN/OUT SEQUENCE 6.5%. If one combines the behaviour TEAT IN/OUT SEQUENCE with STIMULATES, as both appeared to have the same effect on the infant, then what probably tends to differentiate the two groups of mothers is the amount of stimulating behaviour. In bottle feeders it is 43.5% of total Mother behaviours, and in the breast feeders is 31%. This trend would then fit in with the earlier suggestion that possible differences in Mother behaviours according to technique is that bottle feeding mothers are more likely to respond to infant behaviour occurring whilst the teat/nipple is in the infant's mouth, as 88% of the bottle feeding mother's stimulation behaviours occur when this is the case.

The other finding which appeared to reflect differences in Mother's behaviour according to technique concerned the potential infant satiety signals of REFUSES TO OPEN and STOPS SUCKING. Possible reasons for these differences were also looked at through a more detailed analysis of the Mother's behaviour.

In respect of REFUSES TO OPEN, there was a suggestion that whilst breast feeding mothers most frequently allowed INFANT TO DETERMINE OUTCOME, the bottle feeding mothers as frequently CONTROL OUTCOME as allowed the INFANT TO DETERMINE OUTCOME. (See Table 6.6). On closer inspection of the actual Mother behaviours contributing to this trend, (See Tables 6.7 and 6.8), it looks as though the potential difference lies in the bottle feeding mother's persistence in trying to get the infant to take more. They engage in more TEAT OVER LIPS (17 to 7), slightly more STIMULATES (15 to 10) and

are the only group to PUSH IN THE TEAT (9 to 0). In contrast, the breast feeding mothers engage in more DECIDES TO FINISH (14 to 7) and are the only group to OFFER THE NIPPLE (8 to 0).

In STOPS SUCKING, there was the suggestion that whereas breast feeding mothers most frequently engage in behaviour which is in the group MOTHER CONTROLS OUTCOME, the bottle feeding mothers were as likely to engage in behaviour related to INTERRUPTS FEED as MOTHER CONTROLS OUTCOME. When the individual Mother behaviours are examined (See Tables 6.7 and 6.8) what is apparent is that the difference lies in the frequency with which the bottle feeding mothers REMOVE THE TEAT (19 to 5) and WIND (5 to 0). Both these behaviours could in fact be interpreted as a further desire to encourage their infants to feed, as there is no suggestion that this interruption has anything to do with finishing the feed. It could, therefore, reflect simply another form of stimulation.

In summary then it looks as though both Maternal and Infant factors contribute to the characteristics observed in the Mother-baby related behaviours. The infant factors were a result of differences in the potential infant signals available according to the technique of feeding. Whilst the maternal factors appeared to be related to the bottle feeding mother's apparent increased stimulation when the infant was actually feeding, her rather greater persistence in attempts to get the infant to feed even though REFUSAL TO OPEN was present, and a slightly greater likelihood of her interrupting the feed when the infant STOPS SUCKING. This trend in the bottle feeding mother's mode of behaviour does not, therefore, seem to reflect just an overall increased tendency for her to CONTROL the feed, but rather, something to do with the nature of the control. A possible picture emerging is that of the bottle feeding mother being more

actively engaged in getting the infant to feed despite the infant behaviour, whilst the breast feeding mother, although also giving encouragement to her infant to continue feeding, is then more likely to allow the infant to determine the outcome. As no assessment by age was carried out in the latter analysis because it would have involved a large number of categories with many relatively small frequencies, any relationship between the general findings presented in Tables 6.6 to 6.8 and those presented in Table 6.5 can only be speculative. What can only be suggested in conclusion is the probability that infant factors make their contribution from the early weeks, whilst the maternal factors may not become established until around WEEK 12.

6.5 CHARACTERISTICS OF MOTHER INDEPENDENT BEHAVIOURS

To explore further the nature of Mother's behaviour during infant feeding, the mother independent behaviours were then analysed.

The first factor which emerged was that mother independent behaviours are significantly more frequent in the bottle feeding mothers at all ages. In fact, after WEEK 8, the number of mother independent behaviours in the breast feeder is small (See Table 6.9).

The individual mother behaviours also reflect differences according to technique. The breast feeding mothers only engage in two activities, STIMULATES and TAKES OFF, occurring with a frequency of 26 and 49 respectively. Whereas the bottle feeding mothers engage in four activities: STIMULATES, REMOVES THE TEAT, PUSHES IN and TEAT IN/OUT SEQUENCE. The most frequently occurring behaviour is REMOVE THE TEAT (132), then TEAT IN/OUT SEQUENCE (71), STIMULATES (62) and finally PUSHES IN (28). Not only in the number of

TABLE 6.9

Overall Frequency of Mother Independent Behaviours by AGE and TECHNIQUE.

AGE IN WEEKS.	TOTAL FREQUENCY OF MOTHER INDEPENDENT BEHAVIOURS.		SIGNIFICANCE LEVELS *
	BREAST	BOTTLE	
1	21	57	U = 5 p = .002
4	22	28	U =21 p = .05
8	11	29	U =13 p = .02
12	9	44	U =6.5 p = .02
16	6	53	U = 2 p = .002
20	4	45	U =10 p = .05
24	2	37	U = 1 p = .02

* Mann-Whitney - U Two Tailed Test. (Siegal 1956)

behaviours, therefore, does the bottle feeding mother appear to be more active. This appears in the comparable behaviours, where they appear to interrupt the feed more and engage in more stimulation. This suggested trend is partially confirmed when the individual frequencies are compared statistically. From Table 6.10, bottle feeding mothers are significantly more likely to engage in stimulation than breast feeding mothers at most ages if STIMULATES and TEAT IN/OUT SEQUENCE are again combined. However, significant differences between TAKES OFF the Breast and REMOVES TEAT are only evident at WEEK 1 ($p = .05$), WEEK 16 ($p < .02$) and WEEK 20 ($p < .002$). (See Table 6.11), although are more frequent behaviours at all ages.

These differences found according to technique, however, certainly cannot, on this occasion, be explained by the nature of the potential infant signals. So it only leaves characteristics

TABLE 6.10

MOTHER INDEPENDENT BEHAVIOUR: STIMULATES TO SUCK by AGE and TECHNIQUE.

AGE IN WEEKS	BREAST (STIMULATES)	BOTTLE (STIMULATES AND TEAT IN/OUT SEQUENCE)	SIGNIFICANCE LEVELS *
1	8	29	U = 7.5 p=.002
4	11	13	NS
8	3	13	U =14.5 p=.02
12	1	26	U = 8 p=.02
16	3	23	U = 7 p=.002
20	0	16	-
24	0	13	-

*Mann-Whitney - U Two Tailed Test. (Siegal 1956)

TABLE 6.11

MOTHER INDEPENDENT BEHAVIOUR: TAKES OFF BREAST and REMOVES TEAT by AGE.

AGE IN WEEKS	TAKES OFF BREAST	REMOVES TEAT	SIGNIFICANCE LEVELS *
1	13	25	U = 20 p=.05
4	11	15	NS
8	8	14	NS
12	8	16	NS
16	3	20	U = 7.5 p= .02
20	4	23	U = 2 p = .002
24	2	19	NS

*Mann-Whitney - U Two Tailed Test. (Siegal 1956)

inherent in the technique as potential factors independent of mother herself. Potential characteristics are amount left in bottle and time infant has been on the breast. In the pilot study it appeared that each could influence both the frequency of stimulation and the reason for interrupting the feed. To see whether there is any evidence that these influences might be related to interruptions in the main study TAKES OFF and REMOVES TEAT were analysed in more detail.

From Table 6.12(a) it can be seen that in the breast feeding mothers, TAKES OFF tends to occur more frequently in the middle of the feed, and in the early weeks does appear to be mainly because the infant has fed for ten minutes on the breast. But after WEEK 16, when it occurs, it is to change side independently of any observed tine rule (See Table 6.12b). So that there is some support for the suggestion that TAKES OFF is a possible characteristic feature of time in the technique of breast feeding. As the mother becomes more familiar with her infant, she may no longer, however, consider time and so changes the infant according to other criteria thus accounting for the observed decline in this feature.

The reasons why the bottle feeding mothers take out the teat are shown in Table 6.13. The most frequent behaviour is WINDS (51%), then because the bottle is empty (24%), with ACT AS STIMULATION (7%) to GIVE SOLIDS (12%) and APPEARS TO HAVE HAD ENOUGH (5%) forming the remaining groups. There is, therefore, some evidence that an empty bottle is a characteristic of bottle feeding. But it is not the over-riding reason why the bottle feeding mother takes the teat out. This is to WIND. Certainly one could speculate that it is also a consequence of the bottle as various

TABLE 6.12

Mother - Independent Behaviour: TAKES OFF by Age, PLACE in FEED and REASON in BREAST FEEDERS.

AGE IN WEEKS	(a) PLACE IN FEED				(b) REASON FOR TAKES OFF			
	Beg.	Mid.	End	Total	Time up (Half-way)	Time up (2nd - side)	Changes side-No time limit.	Pause
1 N = 11	2	7	4	13	6	4	3	0
4 N = 11	1	7	3	11	3	3	4	1
8 N = 10	0	5	3	8	5	2	0	1
12 N = 6	0	5	3	8	3	3	2	0
16 N = 9	0	3	0	3	0	0	3	0
20 N = 6	0	4	0	4	0	0	3	1
24 N = 3	1	1	0	2	1	0	1	0

explanations in terms of aspects of the bottle are often given as a cause of wind. But there is no evidence for this in the analysis, and so there is little support for the idea that potential characteristics of the bottle are related to interruptions in the bottle feed, apart from an empty bottle.

One is, therefore, left with the conclusion that characteristics of Mother-Independent behaviour also reflect differences according to technique with the bottle feeding mothers considerably more likely to engage in this form of behaviour. However, the nature of the behaviour is more difficult to identify than in the Mother-baby related behaviours. All that emerges is that yet again there is a picture of bottle feeding mothers interrupting the feed more and

TABLE 6.13

Analysis of Mother-Independent Behaviour: TAKES-OUT by CONSEQUENCE and AGE in BOTTLE FEEDERS.

AGE IN WEEKS	Acts as Stimulation			Winds			Appears to have had enough (or a Pause)*			To Give Solid			Bottle Empty		
	Beg.	Mid.	End	Beg.	Mid.	End	Beg.	Mid.	End	Beg.	Mid.	End	Beg.	Mid	End
1 N = 9	0	0	0	5	8	4	0	0	2	0	0	0	0	0	6
4 N = 8	0	3	0	2	6	0	0	0	0	0	0	0	0	0	4
8 N = 9	0	1	2	2	6	0	0	0	1	0	0	0	0	0	2
12 N = 10	0	0	1	1	7	1	0	1	0	0	1	0	0	0	4
16 N = 9	0	0	1	2	4	3	0	0	0	2	3	0	0	0	5
20 N = 10	0	0	1	2	6	2	0	0	1/2*	1	2	1	0	0	5
24 N = 10	0	0	0	2	2	2	0	0	1	4	2	0	0	0	6
TOTAL	0	4	5	16	39	12	0	1	5/2*	7	8	1	0	0	32

engaging in an increased amount of stimulation. But no further support could be given to the idea that differences in technique could be described in terms of infant control versus mother control through characteristics inherent in the technique, other than by implication.

6.6 SIGNAL VALUE OF INFANT BEHAVIOURS.

Having discovered that there are differences in the mode of Mother's behaviour according to technique, what remained to be assessed was the signal value of the infant behaviours for the mother. It was concluded from the analysis of the infant behaviours that two states are signalled: satiety and upset.

If one takes satiety first, the potential infant behaviours concerned are STOPS SUCKING, REFUSES TO OPEN and COMES OFF. What emerged from Chapter 5 was that COMES OFF does not only occur at the end of the feed. It was, therefore, described as a behaviour which is not unambiguously a signal of satiety. However, as it does appear to be the only infant behaviour with REFUSES TO OPEN associated with the Mother-baby related behaviour DECIDES TO FINISH (See Table 6.7), it does suggest that breast-feeding Mothers may possibly be able to distinguish between its proposed meanings and, through this, recognise it as a satiety signal. How this may be achieved is through a testing procedure using OFFERS NIPPLE and NIPPLE OVER LIPS. If so this may then explain why there appeared to be a rather random grouping of infant behaviours following COMES OFF, evident particularly in the early weeks. (See Table 5.14, p.134)

In appraising the value of REFUSES TO OPEN, in the breast feeding mothers it has been shown that they do indeed DECIDE TO FINISH the feed most frequently in relation to this infant behaviour.

(See Table 6.7). But it is also evident that mothers show a great variety of other behaviours. As these were collectively more related to the category INFANT DETERMINES OUTCOME (See Table 6.6), it was proposed that the decision to finish the feed was not taken without further confirmation and in signal value is, therefore, positive but not strongly so. In the bottle feeders this potential signal value appears to be even weaker. What has emerged is that the bottle feeding mothers show relatively more persistence in getting their infants to continue feeding, going to the lengths of pushing in the teat. So that although eventually they do show some indication that they will DECIDE TO FINISH, it is by no means the most frequently related behaviour.

STOPS SUCKING, even if it has the potential to act as a satiety signal, does not seem to be related to mother behaviours which have much to do with terminating the feed. On only three occasions throughout the six months do breast feeding mothers take the infant off the breast. Even though it has been shown that bottle feeding mothers are much more prone to removing the teat, this was not to terminate the feed. NO FURTHER SUCKS from the infant is not the predominant following infant behaviour of STOPS SUCKING. (See Table 5.10). However, it cannot necessarily be assumed that it is not accepted as a satiety cue by the mother, since the very frequency with which it is related to stimulation or an interruption in the feed may be a consequence of its potential effect. What could be happening, therefore, is that mother does not wish to accept the message, a proposition requiring further analysis before it can be excluded.

From the analysis of the infant behaviour CRY/PROTEST, it was suggested that it possibly indicated some sort of upset. The

Mother-baby related behaviours most frequently associated with it is WINDS in the bottle feeder and WINDS/CHANGES BREAST in the breast feeder; that is the category INTERRUPTS FEED (See Tables 6.7 and 6.8). It looks, therefore, as though it is related to an interruption in the feed, particularly so in the bottle feeder when CHANGES IN SUCK PATTERN, and STOPS SUCKING are the most frequent preceding groups of behaviours and so even looks mother induced. As the second most frequent Mother-baby related behaviour is TEAT OFFERED it suggests that mothers probably treat it as protest for more. Only once throughout the entire six months did a mother DECIDE TO FINISH. A similar picture emerges in the breast feeders although within this context it is possibly infant induced since it is most frequently preceded by COMES OFF. (See Table 5.14). Again, only one mother ever DECIDES TO FINISH the feed in relation to CRY/PROTEST. As in the bottle feeders, after WINDS and CHANGES SIDE, OFFERS THE NIPPLE and PUTS ON are the most likely Mother-baby related behaviours. Breast feeding mothers, therefore, also appear to treat it, to some extent, as a 'protest' for more food.

6.7 DISCUSSION.

What has emerged from the analysis is that the way mothers behave within the feed appears to depend upon the way the infant behaves, possibly upon characteristics inherent in the feeding technique, and even more speculatively upon the age of the infant.

Differences in the form that Mother-infant interaction takes during the feed has also been reported by other workers. (Brody, 1956; Ainsworth and Bell, 1969; Sander, 1962; Sander and Julia, 1966; Burns, et al, 1972; Richards and Bernal, 1972; Thoman, et al, 1972; and Dunn, 1975). Most of the studies focus on the qualities

of mothering and how these affect the nature of Mother-infant interaction and thus the course of the feed. What is proposed is that sensitivity to the infant's signals, how much the mother allows the infant to pace the feed and the interest which she shows in her infant during the feed are primary factors upon which the outcome of the feed depends. The Edinburgh study illustrates how some of these qualities of mothering may themselves be dependent upon the nature of the infant behaviour observed. REFUSES TO OPEN, CHOKE and CRY/PROTEST were infant behaviours showing a high mother response index; COMES OFF a variable mother response index and only in the breast feeding mothers; and CHANGES IN SUCK PATTERN, EYES CLOSING and STOPS SUCKING variable mother response indices across the techniques. Both the nature of the behaviour and the technique, because they may affect how the mother behaves, would certainly influence any measure of her sensitivity within the context of feeding. This is best exemplified through the infant behaviour COMES OFF. It was found to play a considerable part in determining whether mother allowed the INFANT TO DETERMINE OUTCOME, yet it only occurred in breast feeding infants. The general trend of these findings in fact complements those reported by Dunn (1975) where it was shown that infant variables AND technique affect the way mothers respond. Age, length of labour, the time which the infant took before its first cry, and whether the infant was breast or bottle fed, all influenced the course of the feed.

Because it was difficult to separate out the potential effects of age in this part of the study, only speculations could be made on the general findings following the initial categorisation according to the four groups. (See Table 6.5). It was proposed that when considering the relative contribution of infant and maternal factors

for the differences found across techniques in the mode of mother's behaviour, the infant factors were probably effective from the early weeks but the maternal factors only seemed to appear around WEEK 12. This raises an interesting question of how much of the mother's behaviour is learnt from the way the infant behaves and how much alters the infant's behaviour. Sander's (1969) description of particular case histories implies that it may take at least three weeks before the characteristics of the pattern of Mother-infant interaction stabilize. It was thus suggested that whatever happens in the first few weeks of life may not set the pattern for the next stage. Indeed, as Dunn (1975) subsequently showed, the nature of the early feeding is not reflected in the mother's affectionate behaviour later on, and is thus not a good predictor of general Mother-infant interaction patterns outside the feeding situation. However, this was not necessarily true of the interaction patterns during the feed as the differences found between breast and bottle feeders were even more marked at the older age in which they were studied. The differences most apparent in this study are the greater tendency for breast feeding mothers to allow the INFANT TO DETERMINE OUTCOME and the greater tendency for the bottle feeding mothers to CONTROL OUTCOME. Both remain features throughout the six months and also became more striking in the older infant. The form of the bottle feeding mothers general mode of behaviour may have potentially important implications for the infant's progress. Rather than the mother learning from her infant, she may limit the experiences available for the infant and thus inhibit the potential capacity for development. In contrast, the general mode of behaviour by the breast feeding mother may actually encourage development. Throughout Chapter 5, age effects were conspicuous by their

absence in the bottle feeding infants, and by their presence in breast feeding infants.

Characteristics of the particular technique which may directly influence the mother's behaviour were appraised through an analysis of mother-independent behaviours. Although clear differences in their actual presence were observed, any influence of specific characteristics were less easy to identify. In the breast feeding mothers, the time that the infant was on the breast did seem to have a considerable bearing on mother's independent behaviour, but features inherent in bottle feeding were less obvious. Whilst the influence of an empty bottle was apparent, other factors could only be imputed from the observed behaviour and its possible consequences.

The last question to be answered was how far infant behaviours which have the potential to indicate a change in state actually do so. What emerged was the finding that certainly upset, as a protest, does; the interpretation being based on the likelihood that mothers would return the food source rather than finish the feed. Differences according to technique appeared to be rather in the potential source of the upset. In the bottle feeding infants it was the Mother, whereas in the breast feeding infants it seemed most likely to be a result of the infant himself. Thus, the possible reason why it appeared earlier in the breast feeding infant might be two-fold. One that indeed, as Bernal and Richards (1970) suggest, the breast feeder may be more hungry. But an alternative hypothesis is that it is linked to the frequency with which the infant COMES OFF the breast. Upset in the infant may thus be related to some sort of frustration at not being able to get the food.

Although the mother may perceive the potential infant signals of satiety, she does not always use them to terminate a feed.

This was particularly apparent in the bottle feeders, independently of the fact that after WEEK 16 the signals are virtually absent from the infant's repertoire. Whether this lack was due to the mother's failure to recognise the signal, her misinterpretation of the signal or her determination to over-rule it, could not be determined without further analysis. But one problem that faces the bottle feeding infant, whatever the outcome, is that mothers can more easily insert the teat against the infant's wishes and then stimulate sucking through intra-oral stimulation. It is known that sucking can be so stimulated even in the satiated infant, (Jensen, 1932; Bridger, 1962; Levine and Kaye, 1966). In the breast feeding infant this is much more difficult to achieve because the nipple must fill the infant's mouth right to the palate and the dorsum of the tongue if it is to stimulate infant sucking, (Gunther, 1955, 1958). If the infant REFUSES TO OPEN, then further sucking cannot be induced.

In concluding this Chapter, the hypothesis regarding the mother's part in the infant's expression of satiety needs to be appraised. What emerged is that whilst there do appear to be differences in the way mothers behave towards the infants' potential satiety signals, there is no clear evidence that they necessarily influence their expression. The only possible support could come from the controlling mode of behaviour in the bottle feeding mothers. But there was no substantive evidence that the controlling mode of behaviour of the bottle feeding mother actually affects the infant's expression of satiety. Infant factors were the only factors which could be said to influence the expression

and from Chapter 5 these appeared to be a consequence of both technique and age.

CHAPTER SEVEN

GENERAL DISCUSSION, CONCLUSIONS AND CLINICAL IMPLICATIONS

A group of mothers and infants were observed over the first six months of the infant's life and a comparison made between the techniques of feeding. Because of the time consuming nature of a longitudinal study, the sample upon which the results of this thesis are based is small. This has meant that the findings are better considered as tentative, suggestive of trends rather than firm conclusions, with perhaps the greater contribution being an attempt to develop observational techniques for examining the issues presented and for the generation of further hypotheses which can subsequently be put to the test.

The methodology and level of analysis was designed to describe, in developmental terms the way in which satiety is expressed behaviourally by the infant during milk feeding. The focus was on the macrostructure of the feed rather than its microstructure. Therefore, subtle changes in sucking were not analysed and inevitably details about the actual way the infant alters his sucking to the various changes in the food supply have been lost. Also, because the data is obtained from the video-tape records, tactile cues between the mother and her infant such as the infant's resistance to the removal of the teat, or the reduction in strength of the infant's suck at various stages during the feed were not available. So that in assessing the value of the infant behaviours as potential signals, certain cues available to the mother may well have been missed. Equally, as the focus of the study was on the milk feeds, aspects of spoon feeding were not considered, except indirectly, although in the older infants, milk feeds occurred in conjunction with the

introduction of solids. These may well affect the underlying mechanisms involved in the expression of satiety since differences in taste, texture and the form in which the calorie content appears are all introduced. Currently, analysis is under way into the nature of spoon feeding, including the effects on milk feeding of the introduction of solids. Any future study looking at the mechanisms involved would also need to take these factors into account.

With the methodological and conceptual issues raised in Chapters 5 and 6 and the limitations outlined above in mind, the analysis, nevertheless, produced findings which have prompted discussion around some aspects of feeding behaviour which do not appear to have been seriously examined in the literature. They have also highlighted the importance of considering not only the age of the infant, but also the feeding technique when assessing mother-infant interaction.

Referring first to the four hypotheses initially set up in Chapter 1, from the results, some of these were given tentative support, whilst for the others no clear conclusions could be made.

Hypothesis 1 was that the potential for the expression of satiety is present at birth. This was examined in Chapter 5, and the following findings emerged: -

1. STOPS SUCKING, REFUSAL TO OPEN and COMES OFF were identified as behaviours having the potential to act as satiety signals.

2. They were present in the newborn, although COMES OFF was only observed in the breast feeding infant.

Tentative support was thus given for this hypothesis.

Hypothesis 2 was that the method of expression of satiety changes with age. This was also examined in Chapter 5 and what emerged was that: -

1. STOPS SUCKING tends to drop out of the feeding repertoire around WEEK 12 in the breast feeding infant and WEEK 16 in the bottle feeding infant.

2. REFUSAL TO OPEN tends to decline in frequency over age in the bottle feeding infant after WEEK 16.

3. COMES OFF has the potential to take over the role of expressing satiety in the older breast feeding infant, but there appeared to be no comparable behaviour in the older bottle feeding infant, so that no potential satiety signals were observed.

Thus tentative support was also given to this hypothesis, although even more caution was needed when appraising the results because statistical analysis could not be carried out on all the sample.

Hypothesis 3 was that the feeding technique makes a difference in the expression of satiety through the different behaviours expressed by the infant. This again formed the subject matter of Chapter 5. The results are incorporated with those presented above and, as it can be seen, this was an hypothesis which was also given some support because of the differences in behaviour found.

In the process of testing these three hypotheses, the reliability of the behaviours potentially able to express satiety also emerged. Taking as potential success in signalling behaviours appearing consistently at the end of the milk feed, it seemed that:

1. REFUSAL TO OPEN was the most reliable signal in the younger infant.

2. STOPS SUCKING only becomes reliable in the breast feeding infant at WEEK 4, and the bottle feeding infant at WEEK 12.

3. COMES OFF was a behaviour potentially capable of representing several different characteristics. These were suggested as: -

   (a) the limited capacity of the infant to remain on the breast,

   (b) a means of interrupting the feed, and

   (c) a potential satiety signal.

Hypothesis 4 was that the caretaker-infant interaction plays a part in the infant's expression of satiety. It formed the basis for Chapter 6 and was tested through a general analysis of mother's behaviour. What emerged was that: -

1. Mother's behaviour varied generally according to the infant behaviours present.

2. Mother's behaviour also varied according to the technique,

   (a) in terms of the mother-baby related behaviours, bottle feeding mothers were more likely to stimulate the infant to suck, interrupt the feed, and persevere with feeding despite the infant behaviour, REFUSAL TO OPEN.

   Breast feeding mothers were found to allow the INFANT TO DETERMINE OUTCOME more frequently.

   (b) in terms of mother-independent behaviours, these were significantly more frequent in the bottle feeding mothers.

   (c) proposed characteristics in the technique possibly influencing mother were suggested as time on the breast, the amount of milk in the bottle. There was tentative support for the former but no serious evidence for the latter other than an empty bottle.

3. Signal value of the potential infant satiety signals varied:

   (a) COMES OFF was the behaviour which most readily led the mother to stop feeding.

   (b) REFUSAL TO OPEN had positive signal value in the breast feeders, but not until after some preliminary testing. In the bottle feeders the signal value appeared much weaker, in some instances leading the mother to push in the teat.

   (c) STOPS SUCKING was not related to any mother behaviour immediately concerned with stopping the feed.

Together these results led to the tentative conclusion that whilst maternal factors probably influenced the value placed on the potential satiety signal, there was no substantive evidence to suggest that mother-infant interaction affected the infant's

expression of satiety. Only infant factors were evident. The hypothesis was thus not supported by the data available. But the limitations of the procedure do not allow one to generalise.

Discussion of the various findings led to a series of speculations about the differences found, particularly in relation to the technique of feeding. It brought out the possible influence of the composition of milk on the infant's capacity to express satiety and the nature of mother control with its rather closer relationship to the characteristics inherent in the technique than perhaps had previously been recognised. Together, these speculations seem to suggest that the study of the organisation of infant feeding behaviour might, therefore, be considered at different levels of analysis.

From considerations of what signals and mother controls were related to the infant's potential capacity to signal satiety, questions which arose seemed to be concerned with the factors involved in the regulation of food intake. From the literature reviewed, one of the fundamental issues discussed was the degree to which control is a result of internal or external factors. In an attempt to bring together various forms of analysis it begins to look as though, in the infant, at one level answers have been sought through a consideration of the degree to which the infant is actively involved in the feed. It is a position implied by Piaget (1936) when offering an alternative explanation of the young infant's capacity to feed from that of Ripin (1930). But in attempting to unravel the direction of the influences involved, cognitive capacities cannot be considered in isolation from perceptual factors, the underlying regulatory mechanism of feed intake and the context within which behaviour occurs. It is known that infants adjust their sucking in

response to such external factors as the nutrient (Jensen 1932; Kron, et al 1967; Dubignon and Campbell 1969; Nisbett and Gurwitz 1970; Kaye 1972; Desor, et al 1973; Engen, et al 1974 and Johnson and Salisbury 1975); the rate of flow from the nipple (Kaye 1972); the properties of the object sucked (Ardran, et al 1958a 1958b; Colley and Craemer 1958; Peiper 1961; Lipsett and Kaye 1965; Dubignon and Campbell 1968b) and changes in activity of the mammary gland (Isbister 1954). More problematically, it has been suggested that the mechanism for the regulation of satiety is either based on volume regulation (Dubignon and Campbell 1969) or, speculatively, that it is a consequence of learned associations with the properties of breast milk (Hall 1975).

What this study appears to have highlighted is the need to consider the context in which the behaviour occurs when interpretation about causes is being made. This is evident from the factors relating to the characteristics of the technique used and the finding that behaviour can change its meaning both within the feed and according to age, (e.g., COMES OFF). Observations of the form in which breast feeding takes alone demands further analysis of Hall's speculation. The basis for her proposition is that because there are changes in the constituents of the breast milk as the breast empties, infants can learn to use these changes as cues for satiety. But what seems to have been overlooked is the fact that the infants usually feed from two breasts. If taste is a cue for satiety per se, elegant though the idea is, answers as to how it is overruled when the infant feeds on the second side must be sought. One alternative proposition tentatively put forward in this thesis is that these potential taste changes in the breast milk may come to be associated initially as a signal that the breast is emptying. It is an

assumption based on the available evidence that changes in the milk constituents within the feed, parallel the reduction in the amount of milk available. (Hytten 1954). However, this speculation assumes that the infant can actually detect the changes in the milk, an assumption which has not yet been tested. So that before any firm conclusion can be made one should establish whether the changes are perceived by the infant.

Throughout Chapter 6, there was the suggestion that the breast feeding infant had greater control over the feed than the bottle feeding infant. It was speculated that differences arose possibly because the demands from certain characteristics of breast feeding allowed the infant to take a more active part in the feed than was possible for the bottle feeding infant. What did not come out in the analysis was the possible contribution of the breast in the support of the infant's potential capacity to feed right from birth. Certainly differences in the infant's behaviour across the techniques was evident even in WEEK 1, although it was postulated that these reflected differences in the level of arousal consequent upon the availability of food. This does not rule out the possibility that other factors might have contributed to this difference, not least the match between the infant's capacity and the characteristics inherent in the mammary gland. Instead of pursuing the sterile debate of innate versus learned or intelligence versus instinct (Hinde 1966), it has already been suggested by several other workers in the developmental field that what may be of more relevance is the study of the interaction between the organism and the environment. What then matters at birth is the degree to which the environment provides support for the capacities present so enabling them to become functional. In the search for possible factors which may

be involved, it seems worth while, therefore, to take a brief look for evidence of any correlation between the structure and function of the mammary gland and the infant's repertoire of feeding behaviour at birth.

From the literature available, it is possible to identify six characteristics of the mammary gland which might be described in terms of their adaptive qualities:

1. As Brody (1956) pointed out, the breast is physically stable and, therefore, the breast and nipple are always in the same place relative to the mother's orientation to the baby.

2. The nipple is soft and protractile during lactation, and the skin has a rich sensory-nerve supply. (Lancet 1949).

3. The milk is obtained from the breast through squeezing the nipple and withdrawing it from the lactiferono sinuses rather than from sucking it out of the ducts; the mammary gland is responsible for propelling the milk towards the nipple (Waller 1943; Isbister 1954).

4. Milk secretion does not start post-partum until the third day following parturition. Once established the production is continuous.

5. Milk changes in composition both within the feed and throughout the day. (Gunther and Stanier 1949; Gunther 1952; Hytten 1954; Kon and Cowie 1961).

6. Regulation of milk production is principally controlled through the stimulation of the infant's sucking (Slome 1956; Newton and Newton 1962; MacKeith and Wood 1971).

From the literature review on the full-term newborn infant's capacities, what is evident is that: -

1. They can orientate to the food source through the rooting reflex, (Prechtl, 1958);

2. They can co-ordinate sucking, swallowing and breathing, (Halverson, 1944, 1946; Peiper, 1961);

3. They are stimulated to suck when the nipple fills the mouth right to the palate and the dorsum of the tongue, (Gunther, 1955, 1958);

4. They adapt their sucking according to various internal and external factors;

5. They possibly use volume regulation as the internal control for satiety, (Dubignon and Campbell, 1969).

When these characteristics of the mammary gland are matched to the newborn infant's capacity to feed, the following picture emerges. Firstly, even at birth, although the breast feeding infant is unable to change his position unaided, cannot support himself or take food to his mouth, so long as he is placed in the appropriate position with adequate support it can be said that through the rooting reflex, he has the potential capacity to obtain the nipple alone because the breast is a physically stable object. Another link that becomes apparent between breast and infant, concerns the actual delivery of the milk. To obtain the milk from the lactiferous sinuses, the infant must squeeze the areolar skin surrounding the nipple and so take all the nipple into the mouth. There appears to be a built in mechanism such that the stimulus to suck is when the nipple fills the mouth.

The possible relationship between the fact that the milk secretion does not start until the third day after delivery and any related infant behaviour is less immediately obvious. There is a suggestion in the literature that although co-ordination between sucking, swallowing and breathing is present in the newborn, it needs to be practised before becoming fully integrated. (Halverson, 1944, 1946; Peiper, 1961). It would also seem from the work of Johnson and Salisbury (1975) that their inter-relationship during development is complex. Three days might thus provide the infant with time to recover from the birth and yet time enough to learn to achieve a smooth integration between the components. All that the infant would then require is enough food to tide him over this period and enough encouragement to ensure that he will suck at the breast.

This is adequately provided by the colostrum. It is rich in protein and produced in very small quantities. (Kon and Cowie 1961). An alternative possibility is that the limited food intake in the first few days following birth allows the infant to become hungry, activating the feeding mechanism through the arousal system and subsequently ensuring that he sucks vigorously at the breast. This then in turn provides the necessary stimulation for the mammary gland for lactation to become established. Again the same requirements for the infant ensue and are fulfilled by colostrum. So that the marked differences in behaviour found between the breast and bottle fed infant during WEEK 1 (also found by Bell (1966) and Richards and Bernal (1972)), may be a result of just this situation; the consequent apparent depression of behaviour in the bottle feeding infants occurring because they have significantly larger feeds, become "bloated", so depressing the arousal system with the result that the infants are less active. It makes one wonder whether it is not important for the infant to experience a period of hunger for the feeding system to become fully operational.

The match between the infant and breast as it relates to the regulation of food intake seems not unrelated to the latter speculation. Regulation appears to be organised through a balance between the activity of the mammary gland and the infant's feeding cycle. Although milk secretion is chemically stimulated by the hormone prolactin, the main stimulant to production appears to be the infant's sucking. It is crucial not only for the establishment of lactation just discussed, but also for the subsequent amount produced; once established the amount produced being a consequence of the capacity of the breast to produce milk and the infant's level of metabolism

and rate of growth. For this to be achieved, however, the infant first needs to provide more stimulation so that the mammary gland can then respond either by producing more milk within the same time intervals, or by producing the same amount more frequently. The actual temporal patterning observed will thus be a consequence of this interaction and the relevant capacities of each contributor. But what it means is that again the breast feeding infant is an active participant right from birth so long as the feeding system is allowed to function adequately. All that it requires is that the mother responds appropriately to the infant's demands. For the infant to determine the amount of food needed, there must have evolved some means whereby this can be achieved, whereas for the mother to respond "appropriately", what is needed is some built in behavioural mechanisms through which this can be achieved. The results of this study tentatively suggest that these may indeed be present in the feeding repertoire at birth.

If one then tries to look at the match between infant feeding behaviour at birth and the bottle feed, a rather different picture emerges. The bottle is not a stable physical object in the same sense as the breast and thus does not give the same support for the built in orienting movements. The delivery of the milk in the nipple is considerably less certain. The artificial teat tends to block, collapse, vary in its compressibility (particularly according to how long it has been in use) and vary in its rate of flow. Active control by the infant is thus subject to many external frustrations and possibly limits the contribution made by sucking to the process of regulation. Add to this the lack of direct response by the supplier (i.e., the bottle) to the infant's demand in the process of regulation, it would seem that the only built in mechanism of regulation left is that within the feed, namely volume regulation.

A crude mechanism at best, it looks as though it was probably never evolved as the sole method of regulation; a consequence of which may be the frequent vomiting and possetting said to be present in infants who are schedule fed (Blurton-Jones 1972). Overall it would thus seem that the bottle feeding infant is more controlled than he is an active participant, not least because of the lack of opportunity available for him to make use of his built in repertoire of feeding behaviours. Equally the mother could also be said to be at a disadvantage since more is demanded of her than simply responding "appropriately" to the infant's behaviour. She has to replace the contribution made by the mammary gland by a technique that could be described as 'inert', since it offers her no active help, merely plenty of occasions to increase the potentially inherent hazards for the infant. Certainly observations of bottle feeding presented in this study would offer some support for these propositions.

Therefore, in line with the general developmental field, a fruitful approach to an understanding of competence in feeding might be to focus on the interaction between the infant and his environment, with the environment incorporating both the mother's behaviour and the characteristics inherent in the feeding technique. At each stage in development there could be different reasons for progress or delay. In this study the behaviours most vulnerable to developmental delay appeared to be those concerned with terminating the bottle feed although the limitations of the design precluded any thorough analysis of the underlying cause for this finding. It might be worth pursuing this perspective further by comparing the capacities between the breast and bottle feeding infants across different age groups. Not only would this force one to consider feeding capacity more systematically, but it might uncover other possible differences

which would provide further insight into the structure and function of infant feeding behaviour. This brings one to a final comment relating to Bruch's (1974) speculation that errors in feeding behaviour are the result of mothers reinforcing incorrect behaviour. The tentative findings from this study, together with the subsequent speculations, suggests that this may be far too simplistic a model. Bruch presented her view in an attempt to explain the origins of obesity. But it would seem that the wider issues contained within the position that errors or delays result when infants are not able to use their capacity may be an equally useful framework from which answers to such problems as obesity through a behavioural perspective might be sought.

CLINICAL IMPLICATIONS

One of the reasons for pursuing a study of feeding behaviour was for the insights it might give to clinical nursing practice. Current concern is with the problem of infant obesity. The major solution is seen to be a return to breast feeding (DHSS, 1974). But even if recommendations about the form in which feeding ought to take is based on sound reasoning, unless the practioners understand how to facilitate the technique, only frustration will ensue from the edict. Nor would it seem reasonable to assume that artificial feeding, using specially modified cow's milk preparations will disappear; its introduction in the late nineteenth century was through a need to supply a safe alternative to breast feeding (Merritt, 1976). A more constructive approach, therefore, would seem to be a better understanding of the merits and disadvantages of the techniques involved.

Tentative implications that can be drawn from the results of this study principally relate to two issues; the form in which the

regulation of food intake appears, and the degree to which bottle feeding is subject to interruption.

Regulation appears in the practice of infant feeding as concern with whether the infant should be demand or schedule fed. (Weinfeld, 1950; MacKeith and Wood, 1977). Fashions have swung in the past from one extreme to another, with little apparent concern for the inherent contradictions between the two opposing views. That demand feeding assumed that the infant can regulate intake, whilst schedule feeding assumed that external control was required, was never fully discussed in terms of the requirements of the feeding system. Rather it was considered more in terms of the implications each practice had for the child's subsequent personality development. Nor does there appear to have been any appreciciation of the incomplete conceptualization of regulation from either stance, since little consideration was voiced regarding the possible regulation that might occur within the feed. Even to-day, discussions appear to reflect a rather ambiguous approach to the concept. (MacKeith and Wood, 1977). What comes out of this study is the suggestion that the practioners might need to reconsider the concept of regulation used to prescribe treatment. For those involved with mothers who are bottle feeding, the implication is that if the practice is to schedule feed, then the only way the infant can possibly exercise any direct control is over intake within the feed. It emphasises the urgency with which an answer to the question of whether the bottle feeding has the capacity to regulate intake of artificial cow's milk, is needed. For those involved with mothers who are breast feeding, the implications are rather different. What probably needs to be appreciated is that the only method open for the infant to increase the supply once the mammary gland has reached its capacity to produce milk,

is for the infant to increase the frequency of feeding. (Le Magnen, 1972, in his extensive studies on temporal patterning of meals has repeatedly shown that this is one way in which regulation occurs). Thus schedule feeding or any rigid rule about "what time" interval there should be between feeds would be counter productive. That this is a topic which needs to be explicitly formulated is given some support from a preliminary analysis of the mothers' views about the timing of feeds. Although not discussed in this thesis, from an analysis of a hundred interviews carried out in a pilot study to test out the interview schedule, there seemed to be considerable confusion about what is meant by demand or schedule feeding. Nearly all the mothers were reluctant to suggest that they would feed any more or less frequently than between three to four hourly, including those who said they would be demand feeding. (Crow, 1977). This is in line with the earlier findings of Newson and Newson (1963). Before closing the topic of regulation, and with it the subject of satiety, it might be said that whilst it would seem from this study that the young infant has the potential capacity to show that he has had enough, it cannot be assumed that this provides evidence for any regulation that is necessarily tied to the mechanism concerned in weight control. This is a complex subject needing a more thorough approach involving the study of intake over longer periods combined with measures of weight gain. Hence no implications regarding the nature of obesity in infants nor its control can be drawn.

The topic concering the degree to which bottle feeding is subject to interruption appeared in this study in Chapter 6. It was found that bottle feeding mothers showed significantly more mother-independent behaviours. Just how much the various interruptions affected the pattern of sucking, and more particularly,

regulation, was not, however, examined. But the intensive nature of these effects was, nevertheless apparent. Although removal of the teat may sometimes be necessary (because it had collapsed or blocked) this was certainly not always the case. It would seem that what is needed is education on the subject of bottle feeding. When reading text-books on the wider subject of infant feeding, it is surprising that whilst a great deal of space is given to the physiological, biochemical and quasi behavioural aspects of breast feeding, only the physiological and biochemical aspects of bottle feeding are discussed. Indeed in practice, there is an assumption that bottle feeding is something everyone can do without a great deal of supervision. A discussion of caretaker stimulation when the infant is endeavouring to suck, repeated removal of the teat for no mechanical reason, and the infant behaviours having the potential to signal satiety, would not seem out of place. In fact, the subject of mother-infant interaction could be presented in the wider perspective of social development so that feeding could be understood within the background of activities thought to contribute to what Schaeffer (1977) calls mothering.

APPENDIX I.

INDICATORS OF BEHAVIOUR MATURITY IN FEEDING.
(From Gesell and Ilg., 1937)

FIRST QUARTER: 0 - 12 weeks.

Expressional Behaviour Prior to Feeding

Vigorous piercing crying until picked up (0 - 8 weeks).
Less demanding crying, but crying as soon as sees bottle (8 weeks -).

On Presentation of Feed

Tongue surounds lower half of nipple well (6 weeks ff).
Hands are usually fisted (4 - 8 week).
Regards breast or bottle eagerly (10 weeks ff).
Hands contact each other on chest (12 weeks ff).

During Feeding

Hands open as feeding progresses (4 - 10 weeks).
Regards mother's face prolongedly (8 - 12 weeks).
Expels gas during feeding as well as at end of feeding.

On Satiety

Falls asleep.
Face brightens (2 - 4 weeks).

SECOND QUARTER: 16 - 24 weeks

Expressional Behaviour Prior to Feeding.

Sight of bottle or breast now quietens (16 weeks ff).
Smile pleasantly, regard breast and bottle eagerly, often vocalize in anticipation (14 - 16 weeks).
Inspects surroundings in absorbed manner (16 - 20 weeks).
Accepts breast or bottle with eagerness (16 - 20 weeks).

On Presentation of Feed

Mouth poises to receive nipple (16 weeks ff.).
Mouth poises to receive spoon (20 weeks ff.).
Grasps and draws bottle to mouth usually with assistance, but hands release as soon as nipple is inserted (20 - 24)weeks

During Feeding

Tongue holds nipple firmly producing strong suck (16 weeks ff.).
Tongue projects after spoon removed, thereby ejecting food involuntarily (16 - 20 weeks).
Coughs and chokes both with milk from bottle and solids (16 - 20 weeks).
Strong hand to mouth response as nipple or spoon is removed (16 - 24 weeks).
Slumps in sitting in high chair (16 - 24 weeks).
Makes smacking noises with lips (22 weeks).

On Satiety

Expels gas easily and usually spontaneously in sitting position.
Fusses or cries after solid food (16 - 24 weeks).
Throws head back or turns to side.
Brings hands to mouth (16 - 24 weeks).
Ejects food with tongue projection (18 - 24 weeks).

THIRD QUARTER: 28 - 36 weeks

Expressional Behaviour Prior to Feeding

Recognises bottle whilst it is being prepared, produces restlessness and demonstrativeness (28 - 36 weeks).
Not stilled until bottle reaches mouth (28 weeks ff.).
Active anticipation for solid foods, vocalises in chair (28 - 34 weeks).

On Presentation of Feed

Vocalises eagerness as regards bottle, dish, cup or when placed in chair (28 - 34 weeks).
Impatient and eager as sees mother preparing dinner (28 - 36 weeks).

During Feeding

Removes food quickly from spoon (28 weeks ff.).
Draws in lower lip (28 - 32 weeks)
Smacks or presses tongue against palate (28 - 36 weeks).
Bounces on mother's lap (28 - 36 weeks).
Hands reach for dish out of reach (32 weeks).
Chokes easily when drinking from cup (32 weeks ff.).

On Satiety.

Keeps mouth tightly closed (28 weeks ff.).
Razzes (sputtering with tongue and lips) (32 - 36 weeks).
Bites on spoon, nipple, or rim of cup (32 weeks).
Hands become more active, grasps spoon, dish, cup or bottle (28 weeks ff.).
Plays with feeding utensil (28 weeks ff.).
Grasps feed in supine position (32 weeks ff.).

FOURTH QUARTER: 40 - 52 weeks

Expressional Behaviour Prior to Feeding

Active anticipation for solid foods, opening mouth long before mother has filled the spoon.
Waits with self-restraint prior to self feeding (52 weeks ff.).

On Presentation of Feed

Grasps bottle and brings to mouth (40 weeks ff.).
No approach with hands on cup or spoon (40 weeks ff.).
Manifests eagerness or impatient fussing if mother is slow in presenting food (44 - 48 weeks).

During Feeding

Demands play object (40 weeks ff.).
Approximates lips adaptively to rim of cup (40 weeks ff.)
Drinks fairly continuously, 4 - 5 swallows or more (40 weeks ff.).
Spills from corners of mouth as drinks (40-44 weeks).
Pokes with index finger at nipple and food in dishes (44 weeks ff.).
Chews well (44 weeks ff.).
Finger feeds small pieces of food from tray (46 weeks ff.).
Rubs spoon back and forth on tray (50 weeks ff.).

On Satiety

Ejects food with tongue projection (40 weeks ff.).
Razzes (40 weeks ff.).
Pulls self to standing position (40 weeks ff.).
Pivots in sitting position (44 weeks ff.).
Throws bottle to floor (44 weeks ff.).
Hands bottle to mother (48 weeks ff.).

APPENDIX II

CHECKLIST for SCORING INFANT and MOTHER BEHAVIOURS DURING the FEED.

INFANT BEHAVIOURS	BEGINNING			MIDDLE			END		
	Present	Mother looks	Mother Behav.	Present	Mother looks	Mother Behav.	Present	Mother looks	Mother Behav.
CHANGES IN SUCK PATTERN									
STOPS SUCKING									
EYES CLOSING									
REFUSES TO OPEN									
COMES OFF									
SPITS TEAT OUT									
ORAL BEHAVIOURS OF: Mouth Search Finger Sucks									
CRY/PROTEST									
CHOKE									
BURP/POSSET/ HICCOUGH									

APPENDIX III

Average Length and Amount Consumed:
Breast Feeding Infants by AGE.

AGE in WEEKS	AVERAGE LENGTH OF FEED (Mins.)	AVERAGE AMOUNT CONSUMED (Mls)
WEEK 1	23.25	75.45
WEEK 4	20.27	110.55
WEEK 8	19.80	143.20
WEEK 12	18.33	219.67
WEEK 16	14.33	169.33
WEEK 20	8.83	138.00
WEEK 24	9.33	157.30

APPENDIX IV

Inter-Observer Reliability Coefficients for Infant and Mother Behaviours.

Infant Behaviours		Mother Behaviours	
Changes in Suck Pattern	77%	Stimulates to Suck	92%
Stops Sucking	94%	Nipple over infant's lips	100%
Eyes Closing	89%	Teat over infant's lips	100%
Refuses to Open	100%	Offers nipple	88%
Comes Off	100%	Offers teat	84%
Spits teat out	98%	Puts infant on the breast	79%
Oral Behaviours	83%	Pushes nipple in	78%
Cry/Protest	100%	Pushes teat in	90%
Choke	100%	Teat in/out sequence	91%
Burps	90%	Removes teat	100%
		Takes off nipple	100%
		Decides to finish the feed	100%
		Pauses	88%
		Winds the infant	100%
		Changes the breast offered	100%
		Comments	95%

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